

United States naval medical bulletin.

Washington : U.S. Govt. Print. Off., for sale by Supt. of Docs.

<http://hdl.handle.net/2027/uc1.b2951843>

HathiTrust

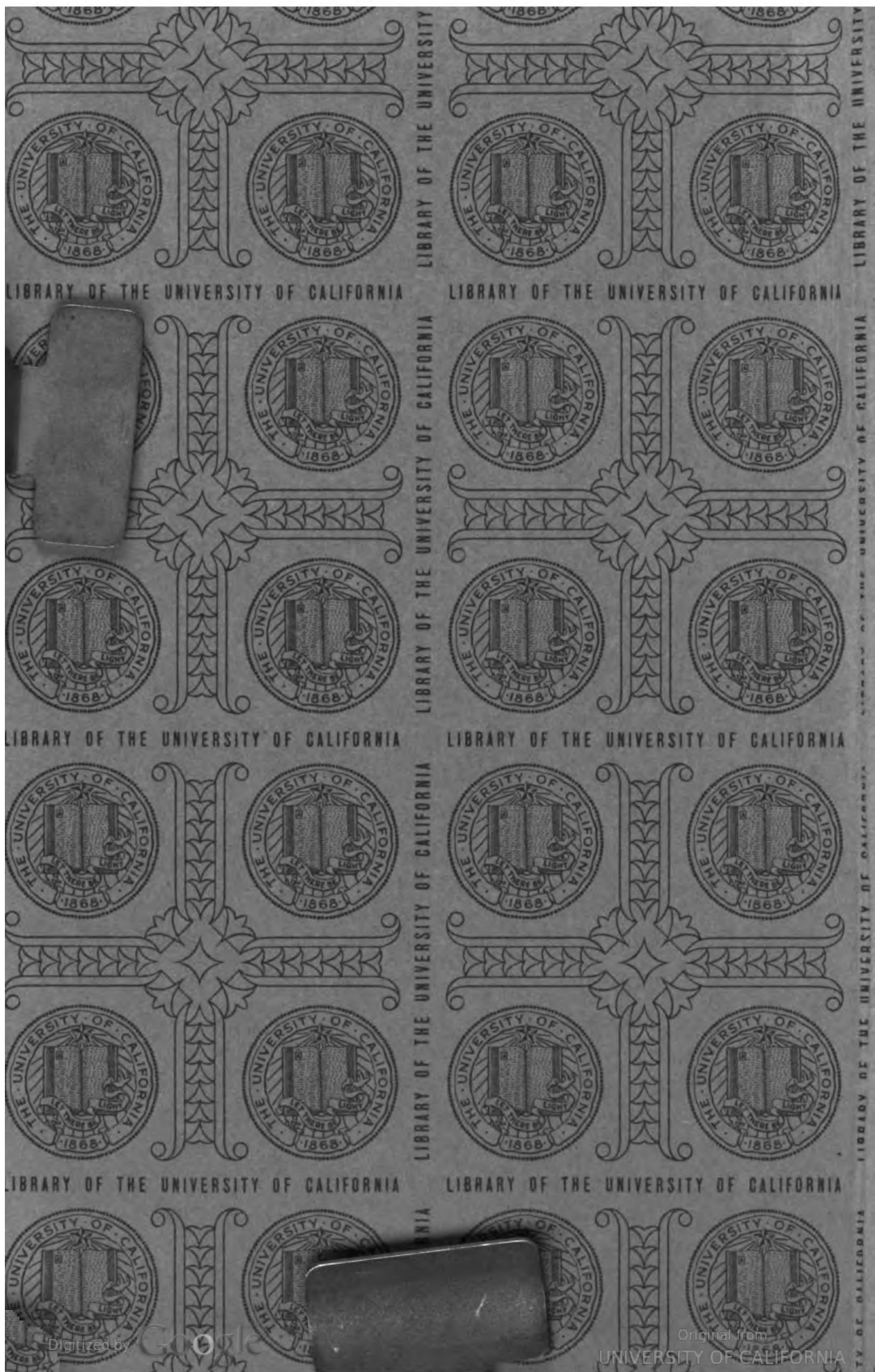


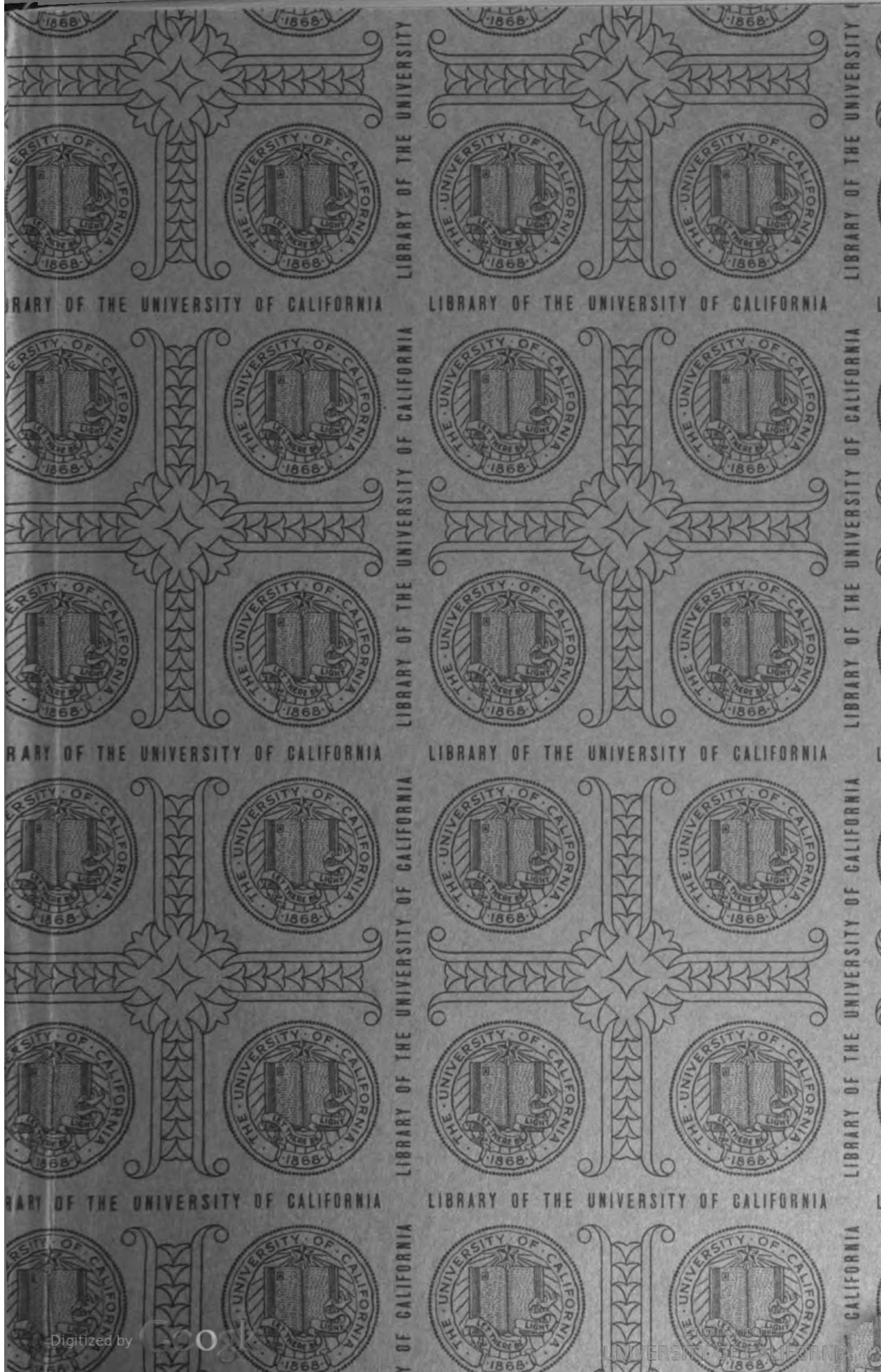
www.hathitrust.org

Public Domain, Google-digitized

http://www.hathitrust.org/access_use#pd-google

We have determined this work to be in the public domain, meaning that it is not subject to copyright. Users are free to copy, use, and redistribute the work in part or in whole. It is possible that current copyright holders, heirs or the estate of the authors of individual portions of the work, such as illustrations or photographs, assert copyrights over these portions. Depending on the nature of subsequent use that is made, additional rights may need to be obtained independently of anything we can address. The digital images and OCR of this work were produced by Google, Inc. (indicated by a watermark on each page in the PageTurner). Google requests that the images and OCR not be re-hosted, redistributed or used commercially. The images are provided for educational, scholarly, non-commercial purposes.





11
55

20

UNITED STATES NAVAL MEDICAL BULLETIN

Catalogue for Biol. Lib.

R11
455 Buch

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

E 48

NUMBER 1



JANUARY-FEBRUARY 1948

Bimonthly

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112

Digitized by

Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPHS

Doctor's office and drug store, Pacific War style, that will cause nostalgia in reverse to many members of the Medical Department of the Navy. The dispensary was at a fighter runway at Nuku Fetau, in the Ellice Islands, and the field drugstore was on Luzon, with Robert T. Hicks, pharmacist's mate, second class, of Waco, Tex., at the mortar and pestle.

—Official U. S. Navy Photos.

VOL. 48

JANUARY-FEBRUARY 1948

NO. 1

UNITED STATES NAVAL MEDICAL BULLETIN

**THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**



BIMONTHLY

**DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY**

Compiled and published under the authority of
Naval Appropriations Act for fiscal year 1948,
Public Law No. 202, approved July 18, 1947

**UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1948**

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page ii for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.



Because the supply of certain numbers of the BULLETIN is exhausted and because of the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated :

All numbers up to and including 1921.

Volume 16, 1922, No. 5.

Volume 17, 1922, No. 4.

Volume 18, 1923, Nos. 1, 3, and 5.

Volume 19, 1923, No. 3.

Volume 20, 1924, No. 5.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, No. 1.

Volume 26, 1928, Nos. 1 and 3.

Volume 31, 1933, No. 3.

Volume 42, 1944, Nos. 2 and 6.

Volume 44, 1945, No. 6.



SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$1.75; foreign subscription, \$2.25.

Single number, 35 cents.

Exchange of publications will be extended to medical and scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

R 11
U 55
v. 48
BIOLOGY
LIBRARY

PREFACE



The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

CLIFFORD A. SWANSON,
Surgeon General, United States Navy.

III

M637253

NOTICE TO CONTRIBUTORS



Contributions to the **BULLETIN** should be typewritten, double-spaced, on plain paper of standard letter size and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions and the style laid down in the Government Printing Office Style Manual for spelling, abbreviations, capitalization, and the use of figures.

All pictures should be unmounted, if possible. Photographs should be glossy prints and charts and drawings made with black india ink.

Contributions are to be the original work of the author and great care should be exercised to enclose in quotation marks quotations which may be introduced. Full credit for the source for these quotations should also be given. Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the **BULLETIN** should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps,
United States Navy.
HILTON W. ROSE, *Assistant Editor,*
Captain, Medical Corps,
United States Navy.

TABLE OF CONTENTS



	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

The Modern Treatment of Progressive Deafness—Clifford A. Swanson and Adrian J. Delaney	1
Liver Abscess—Thomas G. Hays, Robert B. Brown, and Ellwood W. Godfrey	7
Hepatic Amebiasis—Harold J. F. Kullman and Howard Golden	22
Ion Transfer of Penicillin; Efficacy of Penicillin Iontophoresis in Treatment of Chancroidal Ulcers—Armand J. Pereyra	40
Decortication of the Lung in Organizing Hemothorax and Empyema—Edward S. Lowe	52
Therapy of Throat Infections With Bismuth vs. Penicillin—Boris Schuster	61
Radiographic Study of Fractures of the Carpal Navicular Bone—John L. Enyart, Harry J. Brown, and Jack B. Trunnell	66
Cardiac and Electrocardiographic Observations on American Prisoners of War Repatriated From Japan—William M. Fischbach	69
The Naval Station Dispensary—Leon D. Carson	76
A Study of 200 Violators of General Court Martial Probation—William C. B. Johnston and H. Robert Otness	81
Cotton Knots—Ralph L. Byron, Jr	93

EDITORIALS

Advances in the Treatment of Paraplegics	95
Articles of Special Merit Published in the U. S. Naval Medical Bulletin During 1947	96
Revision of the Handbook of the Hospital Corps	97
Nobel Prize in Medicine for 1947	98
Applicants Sought for Commissions in Naval Medical Service Corps	98
Fluids and Blood Substitutes in Treatment of Burns	99
The Treatment of Frostbite	99

	Page
Medical and Dental Officer Deaths to be Published in the U. S. Naval Medical Bulletin.....	100
NOTICES OF DEATHS IN MEDICAL AND DENTAL CORPS.....	101
CLINICAL NOTES	
Tularemia; Report of a Case—<i>Henry R. Cooper</i>.....	102
Bronchiogenic Cysts of the Mediastinum; Report of a Case—<i>Robert B. Brown</i>.....	107
Epidermolysis Bullosa Hereditaria—<i>Paul H. Morton and Thomas C. Deas</i>..	112
Surgical Removal of an Odontoma and Impacted Anterior Teeth; Report of a Case—<i>Ralph W. Taylor and Raymond F. Huebsch</i>.....	116
Chemical Burn of the Esophagus; Report of a Case From Occupation Forces in Japan—<i>Joseph Robert Fox</i>.....	118
The Use of Penicillin in Dental Infections—<i>Maynard K. Elburn</i>.....	120
BOOK NOTICES	
Essentials of Endocrinology, <i>Grollman</i>—The Chemistry of Anesthesia, <i>Adriani</i>—Quantitative Clinical Chemistry Interpretations, Volume 1, <i>Peters</i>—The Anatomy of the Nervous System, <i>Ranson</i>; revised by <i>Clark</i>—Clinical Cystoscopy, <i>McCrea</i>—Renal Diseases, <i>Bell</i>—Gynecological and Obstetrical Pathology, <i>Norak</i>—Textbook for Psychiatric Attendants, <i>Fitzsimmons</i>—Theory of Occupational Therapy, <i>Haworth and MacDon-ald</i>—Mother and Baby Care in Pictures, <i>Zabriskie</i>.....	123
PREVENTIVE MEDICINE	
Pulmonary Tuberculosis: Review of Sixty-Six Cases With Anatomical Findings—<i>Sidney A. Britten</i>.....	132
Potential Mercury Vapor Hazard in a Gyro Laboratory—<i>Clark P. Jeffers, Guido J. Rosati, and Frank A. Jackson</i>.....	139
NOTES ON CONTRIBUTORS.....	147



ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO NO.



WASHINGTON 25, D. C.

20 January 1948

Fellow Officers of the Medical Department:

The Navy Nurse Corps was established in 1908. It was created to bring into the Navy the special knowledge and practice of nursing possessed by trained and registered women nurses. Women possess certain qualities which in many ways make them superior to men in the nursing field. Some of these qualities are intangible, yet paradoxically enough are very real, and of great benefit to the sick or wounded man. The female nurse is also necessary for the proper care of women and children, and even in the early days of the Navy care had to be given dependents at isolated naval stations.

One of the primary purposes of the Navy Nurse Corps was to instruct Hospital Corpsmen in nursing. The actual nursing in combat ships and indeed in most naval units other than hospitals or hospital ships has to be done by Hospital Corpsmen. At the Hospital Corps schools and in the naval hospitals, therefore, great attention was given to teaching nursing to Hospital Corpsmen so they would be able to do this work at sea, with expeditionary forces in the field, and other situations where women nurses could not be employed.

When first established the Nurse Corps consisted of 21 nurses, and the number has always been small in proportion to the number of sick and injured to be cared for by the Medical Department. Therefore, much of the Navy nurses' work is devoted to teaching nursing, operating room work (where they were also of particular value as teachers), and in the administrative details of wards and clinics.

The nursing service by women nurses to the sick and injured has been widely extended. During the war we had Navy nurses in every forward area, and on hospital ships and ambulance planes they entered the actual combat zone. They proved their value there and in the numerous hospitals overseas.

With this more extended use of the Navy Nurse Corps and its gradual increase in size and importance, there has come also a greater demand for more time to be given to the actual nursing of the patient by the woman nurse. This trend is continuing and change in our nursing policies should be made in this direction so that the woman nurse can spend more time in bedside care of patients and yet not impair her administrative duties, and particularly her work as a teacher of the nursing arts.

A handwritten signature in cursive script, reading "C. J. Swenson".

Rear Admiral (MC),
Surgeon General, U.S. Navy.

U. S. NAVAL MEDICAL BULLETIN

VOL. 48

JANUARY-FEBRUARY 1948

No. 1

"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"

SPECIAL ARTICLES



THE MODERN TREATMENT OF PROGRESSIVE DEAFNESS

CLIFFORD A. SWANSON
Rear Admiral (MC) U. S. N.

and

ADRIAN J. DELANEY
Captain (MC) U. S. N.

FOR many years the problem of chronic progressive deafness has been a challenge to otologists all over the world. Various methods of treatment have been tried, from pneumomassage of the eardrum to radical removal of so-called foci of infection, without any consistent results that could be considered satisfactory. It was only during relatively recent years when the cause of progressive deafness became recognized through the efforts of such outstanding otologists as the late George Shambaugh, Sr., of this country, and of Passow of Germany, Jenkins of England, Barany of Austria, Holmgren of Sweden, and Sourdille of France that the surgical treatment of deafness was investigated thoroughly. Clinical research, supported by autopsy findings, has shown that well over 50 percent of all cases of progressive deafness coming to the larger clinics are caused by otosclerosis, and that if the conduction type of deafness only is considered, the percentage caused by otosclerosis is closer to 80 percent. The pathology of otosclerosis was investigated thoroughly, and it

was discovered that the typical lesion was a replacement of the normal hard bone of the ivorylike capsule of the labyrinth by a spongy type of bone which displays some of the characteristics of an inlay tumor. When the pathologic process involves the stapes footplate in the oval window of the middle ear, it causes this important little bone to become fixed and immobile, thus preventing the passage of sound waves from the eardrum to the perilymph of the internal ear, and subsequently to the organ of Corti, the end organ of hearing. This interference with the normal mechanism of stimulation of hearing apparently leads to an atrophy of disuse of the cochlear nerve, in the opinion of some otologists, so that in long standing cases of otosclerosis, a perception type of hearing loss is frequently found, with loss of the high frequencies becoming pronounced as the disease progresses. This high tone loss is not present in the typical case of otosclerosis as we see it clinically in the young adult.

The diagnosis of otosclerosis is not difficult if a high index of suspicion is maintained in our clinical examinations of cases of conduction deafness. A history of the gradual onset of hearing loss for low tones in a patient in her late teens or early twenties often accompanied by an annoying tinnitus, involving both ears, or beginning in one ear and later on becoming manifest in the other, is suspicious. A family history of deafness is usually obtained if the patient is questioned properly. The hearing loss shows a progressive increase as time goes on, in spite of intensive medical treatment such as endocrine therapy, vitamin and amino acid therapy, medicamentation of the middle ear either by drum puncture or eustachian tube inflation, vaccines, x-ray irradiation, or dietary restrictions. The hearing loss may be especially noticeable in females during pregnancy or lactation. The clinical examination of these progressive deafness cases is not very revealing. The ears show no characteristic lesion as a rule. There may be decreased sensitivity of the external auditory canal to manipulation, and there is often a decreased formation of cerumen. But the eardrum is usually normal in appearance and the eustachian tube is open. The so-called "pink promontory" reflex is not seen as often as previously taught. Hearing tests in these cases reveal loss of low tone perception, with good bone conduction, retention of high tone perception, negative Rinne, and prolonged Schwabach. The Gellé test will be positive only when the stapes is definitely fixed, and cannot be relied upon otherwise. The audiometric tests offer the best help in making a diagnosis. The characteristic curve showing considerable loss of hearing for the low tones with an upward trend of the curve for the higher tones, and normal or nearly normal bone conduction for all frequencies is indicative of conduction type deafness. Such a curve in a young patient who has never had a running

ear is almost pathognomonic of otosclerosis. Unfortunately, a definite positive diagnosis of otosclerosis can be obtained only by the pathologist. On the basis of pathologic studies of autopsy material it has been variously estimated that between 10,000,000 and 12,000,000 people in the United States have otosclerosis. Of this number between 1,000,000 and 1,200,000 have sufficient stapes fixation to cause clinical deafness, and to require treatment.

Up to the present time only two forms of treatment have given a return of practical useful hearing in otosclerosis. The modern hearing aid, which is still undergoing refinements to improve tone selectivity and to eliminate extraneous noises, is the only nonsurgical therapy that has stood the test of time. The cosmetic objection to a hearing aid will be overcome undoubtedly in this age of wrist band radios. However, the unnatural quality of the voice and of other ordinary everyday sounds is objected to by many wearers of hearing aids. A difference in the quality of sounds heard by the unaided ear and by the opposite ear wearing a hearing aid is also a cause for strong objection to the use of an aid. The most convincing evidence of dissatisfaction with a hearing aid is seen in the office of the otologist who uses the surgical treatment for the disease. Many of the patients coming to see him for the treatment of their deafness are already wearing an appropriate modern hearing aid, and have already spent a great deal of time and money in learning that there is no successful nonsurgical treatment for their type of deafness.

The only successful treatment for progressive deafness caused by stapes fixation up to the present time is surgery of the labyrinth. The evolution of the early surgical approaches through the many stages of advancement up to the present day fenestration technique has been interesting. In 1876 Kessel created a fistula in the internal ear by extracting the immobilized stapes. Hearing improvement was very brief. In 1897 Passow opened the promontory near the oval window with resultant improvement that was short-lived. Several other surgeons created fistulas in various areas of the labyrinth with immediate hearing improvement resulting, but no sustained improvement was reported by anyone. The surgical treatment of otosclerosis was in general disrepute for many years.

In 1917 Holmgren made a fistula in the superior semicircular canal, and Barany, using a similar technique, created a fistula in the horizontal semicircular canal using a pad of fat to cover the fistula. The hearing gain in Barany's case lasted 14 days, and offered considerable encouragement. Holmgren's tenacity was largely responsible for maintaining interest in the surgical approach to the problem. He used magnification in creating a fistula in the promontory of the cochlea, and used a flap of mucoperiosteum to cover the fistula. His hearing gains were only transient however. In the course of his investigations

Holmgren later made fistulas in the horizontal semicircular canal with some outstanding examples of hearing improvement, but the good results were not lasting as a rule. In the early twenties Sourdille of France described a three-stage operation aimed at maintaining a patent fistula in the horizontal semicircular canal. His results were very encouraging. Holmgren studied Sourdille's technique and tried to improve on it. In 1936 he was able to report many successful results.

The greatest boost was given to the surgical treatment of stapes deafness when Julius Lempert of New York attacked the problem with his endaural method of approach to the mastoid antrum and labyrinth. The creation of a continuous tympanomeatal cutaneomembranous flap from the membrana tympani and the contiguous skin of the superior and posterior walls of the external auditory canal made it possible to complete the operation in one stage. The conception of creating a "window" or "fenestra" rather than a fistula in the bony capsule of the labyrinth was a definite advancement which was made possible by the use of magnification. Refinements of technique in the creation of the fenestra itself have been many. Lempert has found that the chief cause for failure to maintain the almost universal early hearing gains is closure of the fenestra. To overcome this, he has moved the location of his fenestra from the prominence of the horizontal canal to the region of the so-called "surgical dome of the vestibule" where the ampullated end of the canal enters the utricle. This location was chosen because it will support a larger fenestra which can be covered by Shrapnell's membrane and can be expected to remain patent much more frequently than formerly. Lempert has achieved such brilliant sustained results in over 4,000 cases that his method has come to be accepted as the standard of perfection in this work. Other men have adopted his technique, and have also achieved excellent sustained hearing improvement. Thus Shambaugh of Chicago reports on 2,000 cases with a high percentage of long continued improvement.

House of Los Angeles, McLaurin of Baton Rouge, Day of Pittsburgh, Moorhead of Brooklyn, Sullivan of Montreal, Canada, and Passe of London, England, all have series of over a hundred cases in which sustained hearing improvement has occurred in an imposing percentage. Most of these experienced otologists have noticed a distinct improvement in their results in proportion to their improvement in technique and skill.

The surgical treatment of chronic progressive deafness was adopted by the Navy as a logical step in its aural rehabilitation program. The program had been inaugurated in 1943 at the Philadelphia Naval Hospital under the guidance of Francis Lederer of Chicago. It was

felt that a deafened person would not be offered complete rehabilitation unless every effort had first been made to give him a return of practical natural hearing before teaching him to make social, mental, and economical readjustments to his physical handicap. The average sailor or marine is in the age group in which otosclerosis usually reveals its presence first on a clinical level. The deafness of unilateral stapes fixation is frequently noticed in these young enlisted men only after exposure to heavy gunfire, when the resulting tinnitus and temporary deafness makes them conscious of their ears. Properly taken audiograms and fork tests will uncover the true nature of the hearing loss which would otherwise be blamed on exposure to gunfire. If the hearing loss is below the 40 decibel level in the better ears, with good bone conduction, it is the policy of the Navy to operate the worse ear in these cases, to attempt to save them for continued active duty. If surgery is unsuccessful, these young men are given the complete course in aural rehabilitation and are then surveyed out of the service.

At the present time the fenestration operation is being performed at the United States Naval Medical Center, Bethesda, Md., and at the United States Naval Hospital, Philadelphia, Pa. Suitable cases for operation may be transferred to these two centers. About 80 cases have been operated up to the present time, but sufficient postoperative time has not elapsed to present our results. It may be said, however, that the results so far obtained have been sufficiently impressive to assure the continued use of this surgical procedure in the Navy.

REFERENCES

1. The 1946 Year Book of the Eye, Ear, Nose, and Throat. The Year Book Publishers, Inc., Chicago, Ill. p. 383.
2. FARRIOR, J. B.: Fenestration operation for deafness. *J. M. A. Alabama* 16: 317-322, Apr. 1947.
3. FOWLER, E. P.: Otosclerosis, progressive deafness and correlated problems. *Rhode Island M. J.* 30: 105-109, Feb. 1947.
4. MOORHEAD, R. L.: Fenestration for otosclerosis. *Arch. Otolaryng.* 45: 49-60, Jan. 1947.
5. SHAMBAUGH, G. E., JR., and JUERS, A. L.: Chronic progressive deafness including otosclerosis. *Arch. Otolaryng.* 45: 697-717, June 1947.
6. GREENFIELD, S. D.: Evaluation of Lempert fenestra nov-ovalis operation in treatment of otosclerosis; report of 36 patients who were selected for this operation. *Arch. Otolaryng.* 43: 25-30, Jan. 1946.
7. FOWLER, E. P.: Otosclerosis; index of literature with abstracts and index of authors according to subjects for 1943. *Arch. Otolaryng.* 43: 143-150, Feb. 1946.
8. FOWLER, E. P.: Index of literature, with abstracts, for 1944-45. *Arch. Otolaryng.* 45: 215-244, Feb. 1947.
9. ALTMANN, F.: Healing of fistulas of human labyrinth; histopathologic studies. *Arch. Otolaryng.* 43: 409-421, Apr. 1946.
10. SHAMBAUGH, G. E., JR.: Fenestration operation for otosclerosis. *J. A. M. A.* 130: 999-1006, Apr. 13, 1946.

11. **MCLAURIN, J. V.:** Fenestration operation for otosclerosis. *New Orleans M. & S. J.* 99: 209-216, Nov. 1946.
12. **PASSE, E. R.:** Fenestration operation for otosclerosis. *Lancet* 1: 171-174, Feb. 1, 1947.
13. **SHAMBAUGH, G. E., JR.:** Fenestration operation. *Surg., Gynec. & Obst.* 84: 828-838, Apr. 15, 1947.
14. **FOWLER, E. P.:** Twenty years of Research in Otosclerosis and Correlated Problems. Central Bureau of Research, American Otological Society, Inc.
15. **LEMPERT, J.:** Improvement of hearing in cases of otosclerosis; new, one stage surgical technic. *Arch. Otolaryng.* 28: 42-97, July 1938.
16. **LEMPERT, J.:** Endaural fenestration of external semicircular canal for restoration of hearing in cases of otosclerosis; summary of report of 120 cases. 31: 711-779, May 1940.
17. **LEMPERT, J.:** Endaural fenestration of horizontal semicircular canal for otosclerosis. Indications, technique, observations as to early and late post-operative results. *Laryngoscope* 51: 330-362, Apr. 1941.
18. **LEMPERT, J.:** Fenestra nov-ovalis; new oval window for improvement of hearing in cases of otosclerosis. *Arch. Otolaryng.* 34: 880-912, Nov. 1941.
19. **LEMPERT, J.:** Lempert fenestra nov-ovalis with mobile stopple; new advance in surgical treatment for clinical otosclerosis evolved as result of research study of 1,000 cases in which fenestration has been performed during last 7 years. *Arch. Otolaryng.* 41: 1-41, Jan. 1945.



LIVER ABSCESS

THOMAS G. HAYS

Captain (MC) U. S. N.

ROBERT B. BROWN

Commander (MC) U. S. N. R.

and

ELLWOOD W. GODFREY

Commander (MC) U. S. N. R.

IN THE 5-month period from December 1945 to May 1946, 10 cases of liver abscess were treated on the surgical service at the United States Naval Hospital, Philadelphia, Pa. These cases are hereby presented, not as a series for statistical analysis or as an excuse for reviewing in detail the whole subject of liver abscess, but because they illustrate individually many important points in the diagnosis and treatment of this condition.

With the return of our armed forces from various parts of the world where amebic dysentery is endemic, it is reasonable to expect this increase in incidence of the commonest complication of amebiasis, namely, liver abscess. The insidious onset of the disease, its ease of transmission by man under supposedly good hygienic conditions, and the fact that persons may become carriers without exhibiting symptoms combine to make its control difficult. No satisfactory explanation has been offered as to why such carriers may suddenly lose their immunity to the organism and develop a full-blown, active infection with its associated clinical picture.

The diagnosis of liver abscess is in many cases a difficult one and often rests primarily on a high index of clinical suspicion. In cases of pyogenic liver abscess, a history of antecedent infection in the area drained by the portal circulation, usually a suppurative appendix, may furnish the lead to the correct diagnosis. In amebic cases, a history of residence in an endemic area or of previous or associated bouts of diarrhea may be an aid to diagnosis, but too often these helps are lacking.

The clinical picture is anything but characteristic. The right lobe of the liver is most commonly involved and pain in the right upper quadrant of the abdomen or over the lower right chest is the commonest single symptom of suppuration here. The pain is usually dull in character and is intensified by deep pressure or fist percussion. Fever of septic type and chills are common. Weakness, loss of weight,

anorexia, and mild anemia are often associated. Nausea and vomiting are infrequent. An enlarged, tender liver may be demonstrable clinically. Jaundice is unusual.

Laboratory studies are of limited diagnostic value. A significant leukocytosis is usually present and it is apt to be higher in pyogenic liver abscesses or in amebic ones with secondary bacterial infection. The red blood cell count and hemoglobin determination will confirm the mild anemia. Liver function tests, including the icterus index determination and van den Bergh reaction, are not uniformly or significantly altered. Even after repeated, prolonged, and painstaking search, the *Endamoeba histolytica* may not be demonstrable in the stools of amebic cases.

Often the most reliable aid to diagnosis, short of actual aspiration or surgical exploration, is the roentgen examination. Elevation and fixation of the right dome of the diaphragm may be demonstrated by fluoroscopic examination. The elevation is purely mechanical as a result of enlargement of the right lobe of the liver. On the other hand, the restriction of movement is primarily an irritative phenomenon and increases with the proximity of the abscess to the dome. Diaphragmatic movement is least restricted when the abscess is in the under surface of the liver and the restriction of motion becomes greater as the suppurative process approaches the superior surface, culminating in complete fixation associated with subdiaphragmatic collections. Areas of atelectasis or pneumonitis within the lung tissue or fluid in the pleural sulcus are secondary to the inflammatory process below the diaphragm. Serial films, revealing increasing liver size or progressive elevation of the dome of the diaphragm, are of particular significance.

Finally, the diagnostic value of a trial on emetine therapy should not be overlooked in cases of amebic liver abscess.

The treatment of liver abscess, especially of the amebic type, is controversial. Many observers recommend a long trial on medical treatment with emetine and carbarsone, or one of the other anti-amebic drugs, and postulate a high percentage of complete cures without aspiration or surgical drainage. Others combine medical treatment with needle aspiration of the abscesses and report equally enthusiastically on their method.

The cases to be presented in this report were treated by open surgical drainage. We are not using this relatively small series as a text for recommending such treatment in all cases of liver abscess. It is entirely possible that some of these patients might have been cured on a more conservative regimen. On the other hand, in several instances open surgical drainage was definitely the treatment of choice, as we shall attempt to point out in our discussion.

CASE REPORTS

Case 1 (W. L. W.).—This 32-year-old, white male was admitted to the hospital on 22 January 1946 with a chief complaint of epigastric pain of 5 days' duration. The pain radiated to the right upper quadrant of the abdomen and mid-back area and was associated with chills, fever, and severe headache. The patient had had diarrhea for 2 weeks and anorexia for 5 days prior to admission. He had had no nausea or vomiting.

This man had been discharged from the Army on 2 January 1946 but the theaters of operation in which he served were not recorded in the history.

Temperature on admission was 103° F., pulse 112, respirations 28. Physical examination revealed tenderness and rigidity in the right upper quadrant of the abdomen with a palpable mass here. Total white blood cell count was 17,700 with 60 segmenters, 28 band forms, and 2 juveniles in the differential polymorphonuclear cell count.

Penicillin therapy was started on the day of admission and on the following day operation was performed with a preoperative diagnosis of empyema of the gallbladder. A solitary abscess, about the size of a tennis ball, was found on the anterior superior surface of the right lobe of the liver. The abscess was evacuated of sanguino-purulent material, a specimen of which was sent to the laboratory for examination. Culture showed no growth, and no amebae were demonstrated.

The abscess cavity was drained and emetine was prescribed in 1-grain daily dosage. The patient made a rapid recovery and was discharged from the hospital less than 3 weeks following operation.

Comment

This patient presented us with a solitary, uncomplicated abscess of the right lobe of the liver, operated as an emergency under an erroneous diagnosis. Circumstances permitting, a more complete work-up, including stool examinations, roentgenographic studies, and possibly a therapeutic trial on emetine, might have established the correct diagnosis or altered the treatment. The patient's response to open surgical drainage combined with emetine therapy, however, was a very satisfactory one.

Case 2 (W. E. W.).—This 27-year-old, white male was admitted to the hospital on 2 December 1945 with a chief complaint of pain in the right side of the abdomen. Patient had been constipated for 2 weeks, and 5 days prior to admission he had developed fever and the pain of which he complained. There had been no nausea or vomiting. He had noticed blood and pus in one stool.

The patient, who was a sergeant in the Air Corps, had had no overseas duty and gave no history of diarrhea or dysentery in the past.

Temperature on admission was 104° F., pulse rate 112, and respirations 22. Shortly after admission the patient had a chill. Physical examination was essentially negative except for a tender mass in the right upper quadrant of the abdomen which was thought to be liver. The white blood cell count was 25,000 with 69 percent polymorphonuclear leukocytes.

Penicillin was started on the day of admission and emetine was prescribed 2 days later. On the morning of 7 December, the patient experienced sudden, severe exacerbation of the abdominal pain and immediate operation was performed. An abscess was found on the inferior surface of the right lobe of the

liver. It was about the size of an orange, had leaked, and omentum was adherent at the site of perforation. The abscess cavity was unroofed and drained. The pus was of the anchovy sauce type which has been described as typical of amebic infections. Culture of the pus showed no growth. Although the *Endamoeba histolytica* could not be demonstrated in either the pus or a specimen of tissue taken from the abscess wall for histological examination, the pathologist states that the "parasitic nature of the infection is suggested by areas in which eosinophils predominate."

Patient's convalescence was entirely uneventful and he was discharged from the hospital on 21 December, 14 days after operation.

Comment

Again we were presented with a solitary abscess of the right lobe of the liver. Unlike case 1, the diagnosis was suspected preoperatively and emetine treatment was started. However, before further confirmatory studies could be completed, a complication, namely, perforation, demanded operative intervention. Again, the outcome was entirely satisfactory.

Case 3 (E. D. K.).—This 21-year-old, white male was admitted to the hospital on 18 April 1946 with a chief complaint of pain in the right flank. This pain was of 3 weeks' duration, usually dull in character, and increased in severity by sneezing, coughing, or deep breathing. On occasions, it became sharp and radiated to the umbilicus and right shoulder. The pain was accompanied by anorexia and nausea, but no vomiting. The patient had lost 9 pounds in weight. On the day before admission, he had his first chill.

This patient had an appendectomy for a ruptured appendix with peritonitis in November 1944.

Temperature on admission was 102.2° F., pulse 104, and respirations 22. Physical examination revealed tenderness and rigidity of the right side of the abdomen, especially over the right upper quadrant. There was tenderness to fist percussion over the lower ribs on the right. No mass was palpable but dullness to percussion extended well below the costal margin on the right. White blood cell count was 19,000 with 72 percent polymorphonuclears, 9 of which were band forms.

The patient was started on penicillin therapy. Urinary tract studies were negative, as was roentgenographic study of the right diaphragm and lower right chest.

By 24 April the patient was unimproved and operation was performed with a preoperative diagnosis of liver abscess. An abscess was found posterior and lateral, at the junction of the lower and middle thirds of the right lobe of the liver. The cavity was unroofed and evacuated of thick, gray, foul-smelling pus. Abscess was multilocular. Culture of pus showed no growth.

Penicillin and sulfadiazine were given postoperatively, along with a course of emetine, 1 grain daily, for 7 days. Recovery was prompt and continuous and the patient was discharged on 3 June 1946.

Comment

In no one of these first three cases has the etiology of the liver abscess been established beyond question. *Endamoeba histolytica* was not demonstrated in the pus or abscess wall and cultures were negative. Collateral evidence in the first two points to an amebic origin, whereas

in this third case the abscess was probably a pyogenic one. If we attempt to establish a relationship between the ruptured appendix and the suppuration in the liver, we must postulate a latent or subclinical focus of infection of over a year's duration. We know that such a condition is not impossible or even improbable, especially when bacteriostatic chemotherapeutic agents have been exhibited in treatment. The appendiceal site itself was explored at the recent operation for drainage of the abscess and found to be clean. The character and odor of the pus suggested to the operator a pyogenic rather than amebic etiology. Emetine postoperatively was given empirically.

The position of the abscess away from the superior surface of the liver lobe probably explains the failure to obtain diagnostic aid from the radiographic study of the diaphragm and chest.

Case 4. (A. L. R.).—This 23-year-old white male was admitted to the hospital on 1 May 1946, complaining of fever and pain in the right chest. Illness dated back to 27 April, with the onset of fever and malaise. Shaking chills and pain in the lower right chest on inspiration followed. The pain in the chest was accompanied by a dry, hacking cough. Severe diarrhea was present for about 24 hours prior to admission, during which time the patient had approximately 30 stools. These did not contain blood.

The patient had been discharged from the Army on 27 December 1945, following his return from duty in India where he had had dysentery.

Temperature on admission was 101.6° F., pulse 144, and respirations 24. Physical examination revealed a few moist râles over the middle and lower pulmonary lobes posteriorly on the right. There was dullness to percussion and slight increase in tactile fremitus here. The liver was enlarged to percussion and there was tenderness to fist percussion over the lower right chest. The white blood cell count was 17,500 with 80 percent polymorphonuclear leukocytes, 19 of which were band forms.

Penicillin therapy was started on admission. Radiographic studies revealed a high right diaphragm, with marked restriction of its motion. There was a suggestion of pneumonitis and a small pleural effusion above. Warm stools were examined repeatedly for ova and parasites, but no *Endamoeba histolytica* could be demonstrated.

By 15 May the patient was unimproved and operation was performed with a diagnosis of liver abscess. Abdomen was entered through a subcostal incision on the right. Adhesions between the right lobe of the liver and the diaphragm were separated to reveal an extensive area of fluctuation in the dome. A large trabeculated solitary abscess was unroofed and evacuated for sanguino-purulent material and masses and strands of necrotic liver tissue. No amebae were demonstrated in the pus, and culture showed only scant growth of *Streptococcus viridans*.

Postoperatively, the penicillin therapy was continued and the liver abscess cavity was irrigated with emetine in saline solution, 1 gram to 100 cubic centimeters of solution. Convalescence was essentially uneventful and the patient was discharged from the hospital on 1 July 1946.

Comment

Emetine was used locally rather than systemically in this case because of electrocardiographic evidence of myocardial damage. Fur-

ther study and treatment from the standpoint of a possible persisting amebiasis is certainly indicated although recovery from the liver abscess has been quite satisfactory and complete.

Case 5 (C. C.).—This 34-year-old white male was admitted to the hospital on 7 January 1946 complaining of pain in the right lumbar region of 3 weeks' duration. The pain radiated to the right lower quadrant and was aggravated by inspiration. It was accompanied by daily fever and chills.

This patient was discharged from the Army on 28 November 1945 following duty in New Guinea, the Philippines, and Korea. He had had dysentery in New Guinea in August 1944, for which he received medical treatment.

Temperature on admission was 100.3° F., pulse 110, and respirations 22. Physical examination revealed a friction rub over right lower chest with dullness to percussion here. The liver was enlarged to percussion, with tenderness

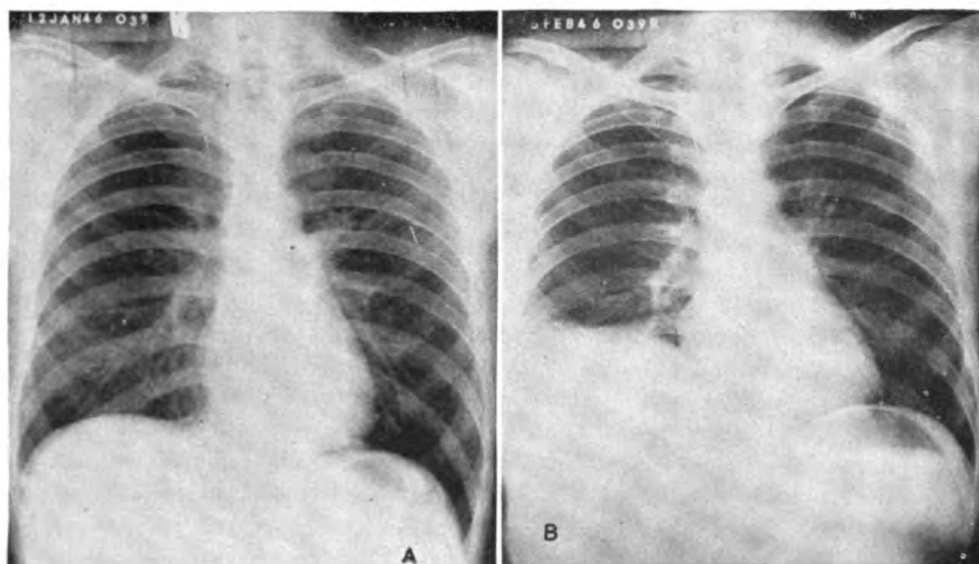


FIGURE 1.—(A) Taken shortly after patient's admission to the hospital and reported as negative. It is included for comparison with (B) which was made approximately 1 month later and which reveals a high right diaphragm, partially fixed as demonstrated by fluoroscopic examination. Note the lung reaction above with a small pleural effusion.

below the costal margin on the right and with tenderness to fist percussion over the lower right chest. Blood count showed a marked anemia and a total white cell count of 14,000 with 7 bands and 56 segmented forms. Roentgenogram of chest revealed nothing abnormal.

The patient was admitted with a diagnosis of pyelitis but urinary tract studies, including intravenous urography, were negative. Repeated stool examinations for ova and parasites were negative.

On 1 February roentgenological examination showed elevation and restriction of motion of the right dome of the diaphragm. There were multiple patchy areas of consolidation at the right base, suggesting atelectasis or pneumonitis. There was a small pleural effusion on the right. Hepatic abscess was suspected. On 5 February the radiographic studies were repeated and revealed further elevation of the right diaphragm with the associated changes at the right base (fig. 1).

Patient was started on penicillin therapy on 2 February. On 8 February the abdomen was opened, with a preoperative diagnosis of liver abscess. One large and two small abscesses were found in the dome of the right lobe of the liver. A total of over 1,500 cc. of thick, creamy pus was removed as the cavities were unroofed for drainage. No amebae were found in the pus and the culture showed no growth.

Postoperatively the patient was given penicillin, sulfadiazine, and a course of emetine. The initial response to surgery was excellent and the fever subsided. In the second postoperative week, after the drains had been mobilized, the patient continued to drain thick, sanguino-purulent material and the septic temperature returned. The subcostal drainage tract was explored and was found to be inadequately draining the large abscess cavity high on the dome of the liver. Direct drainage was obtained by a two-stage transthoracic approach directly over the abscess cavity. Following this procedure, convalescence was rapid and uneventful and all wounds were healed at time of discharge on 29 April 1946.

Comment

A case of multiple liver abscesses, probably amebic in origin. It is the feeling of the authors that the chance of localizing and adequately draining all the suppurative collections in such cases by needle aspiration is nil. In this patient, even a first attempt at open drainage combined with emetine therapy was inadequate, and cure followed only after wide open, direct drainage had been established.

Case 6 (E. M. S.).—This 29-year-old white male was admitted to the hospital on 28 December 1945 with a chief complaint of pain in the right side of the abdomen and flank. He had been in good health until he left the Pacific area 6 weeks prior to admission. On his trip back to the States he developed anorexia, constipation, and burning in the epigastrium. Two weeks before admission he noted a yellow tinge to his skin and at the same time he began to experience pain in the right side of the abdomen and flank with shoulder reference. He had lost about 9 pounds in weight.

This man had had duty in New Guinea, the Philippines, and Japan. He remembered one bout of dysentery while on duty in New Guinea.

Temperature on admission was 103° F., pulse 96, and respirations 22. Physical examination revealed an icteric tinge to the skin and an enlarged tender liver with the edge palpable four finger breadths below the right costal margin. The white blood cell count was 21,000 with 9 juveniles and 30 band forms. Icterus index was 6.

Penicillin therapy was instituted.

Stools were examined for ova and parasites but none were found. Fluoroscopic examination revealed elevation and restriction of motion of the right dome of the diaphragm. Films of the chest (fig. 2) and abdomen showed a small pleural effusion at the right base and hepatic enlargement.

The patient improved and his temperature and white blood cell count became normal. However, tenderness over the liver persisted. On 28 January 1946 the abdomen was opened through a right subcostal incision. The preoperative diagnosis of liver abscess was confirmed. Two small abscesses were found high on the dome of the right lobe, with a much larger one on the anterolateral aspect below. All were drained of grayish, odorless pus. The purulent material and a section of tissue from the abscess wall were examined for *Endamoeba histolytica* but none was found. Culture showed no growth.

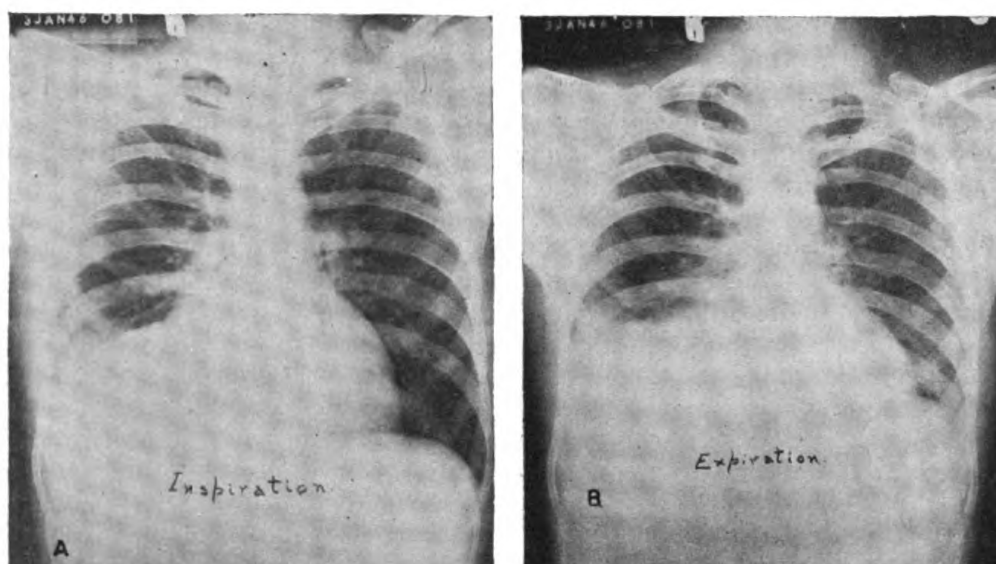


FIGURE 2.—(A) Taken in the inspiratory phase of respiration. (B) Taken in the expiratory phase of respiration. There is elevation and restriction of motion of the right diaphragm with a small pleural effusion above.

The postoperative course was smooth and emetine was given in 1-grain dosage for a week. The patient was discharged from the hospital on 15 February, less than 1 month following surgery.

The patient was readmitted to the hospital on 24 April 1946. Two days before admission he had developed a dull ache in the left shoulder and pain in the left upper quadrant of the abdomen. Patient volunteered the statement that this new complaint was identical to that of his previous admission except for its location on the left rather than the right. Temperature was 101.2° F. and a tender mass thought to be liver was palpable two finger breadths below the left costal margin. Total white blood cell count was 20,400 with 4 bands and 84 segmented forms.

The patient responded to penicillin therapy as before with a drop of temperatures and leukocytes to normal. Stools were again examined for amebae, with negative results. Two 10-day courses of emetine 1 grain daily and a week's course of carbarsone 0.25 gram four times a day were administered and the patient was discharged as cured on 7 June 1946.

Comment

Similar to case 5, this patient had multiple abscesses of the right lobe of the liver, probably primarily amebic in etiology, which healed very rapidly following open surgical drainage. The initial prompt but incomplete therapeutic response to penicillin on two occasions suggests a superimposed bacterial infection but culture of the pus obtained at operation failed to confirm this.

The left lobe of the liver was carefully examined by the operator before the abscesses in the right lobe were drained. Except for slight enlargement, it was negative to inspection and palpation. On the second admission to the hospital, the left lobe was probably the site of an amebic hepatitis. It is entirely possible that this complication

could have been prevented had the patient received more intensive anti-amebic therapy during his first hospitalization.

Case 7 (G. M. W.).—This 27-year-old, white male was admitted to the hospital on 20 January 1946, complaining of cough, fever, and pain in the right lower chest. On 20 December 1945, he had contracted an acute upper respiratory infection with malaise, rhinorrhea, and cough. About 6 days prior to admission he developed fever and pain in the right lower chest, pleuritic in nature. There was occasional reference of the pain to the right shoulder.

Past medical history was irrelevant except for diarrhea while he was in the Pacific which was refractory to treatment and which had continued at intervals to time of admission.

Temperature on admission was 102° F., pulse 100, respirations 20. Physical examination revealed abnormal signs over the right lower chest posteriorly. There was a decrease in tactile fremitus, vocal resonance and breath sounds here with flatness to percussion. No friction rub was heard. There was tenderness and muscle guarding in the right upper quadrant of the abdomen. The liver edge was palpable two finger breadths below the right costal margin. Total white blood cell count was 28,600 with 22 band and 63 segmented forms.

The patient was thought to have pneumonia with a complicating pleural effusion. He was placed in an oxygen tent and on penicillin therapy. Sputum examination revealed a type 10 pneumococcus.

Roentgenogram of the chest taken on the day of admission showed a "dense homogeneous infiltration sharply delineated to the right lower lobe." This was interpreted as a lobar pneumonia. Three days later there was an increase in this density with obliteration of the costophrenic angle, suggesting pleural effusion (fig. 3).

On 25 January 1946 further roentgenological studies were made and reported as follows:

Fluoroscopically, in the horizontal position, the right dome of the diaphragm was fixed. There was a mild increase in density of the lung tissue immediately above, and this may be the result of a resolving pneumonia or small pleural collection. The area of increased density overlying the lower lung field did not shift when the patient was moved from the horizontal to the erect position. In the erect position the right dome moved with coughing, but not with ordinary respiration. The appearance suggests a subphrenic abscess or hepatic abscess adjacent the dome of the diaphragm.

By 26 January the patient was unimproved. Temperature ranged between 100° and 103° F. and leukocytes had risen to 36,000. He was seen by a surgical consultant who concurred with the diagnosis of liver abscess suggested by the

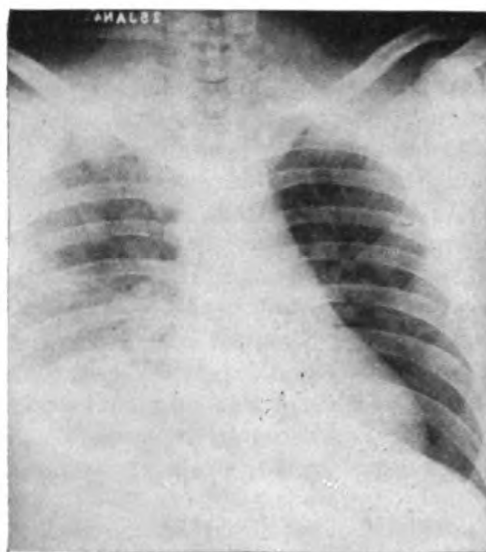


FIGURE 3.—High diaphragm on the right with increase in density of the lung field above. The presence of a right pleural effusion was confirmed by thoracentesis.

radiologist. Stool examination failed to show *Endamoeba histolytica* but patient was started on emetine and operation was performed. The abdomen was entered through a right rectus incision. Right lobe of the liver was adherent to the diaphragm at the dome. The large abscess cavity located here was unroofed, evacuated of about a pint of chocolate-colored pus, packed with iodoform gauze, and drained through an incision in the right flank. Examination of the pus and tissue removed from the wall of the abscess cavity failed to reveal amebae.

On the day following operation, the patient developed atelectasis on the right. This was treated successfully by bronchoscopic aspiration. On 29 January, after 4 grains of emetine had been given, the drug was discontinued because of electrocardiographic evidence of severe myocardial damage. Further convalescence from a surgical standpoint was rapid and uneventful. However, electrocardiographic changes persisted for some time and the patient remained under observation of a cardiologist to 13 May, at which time he was discharged to duty.

The patient was readmitted to the hospital on 7 July 1946 with a complaint of bloody diarrhea of 1 week's duration. This was accompanied by slight abdominal pain, localized above the umbilicus, and a loss of weight of 5 pounds. A stool examination in the out-patient clinic had been reported positive for amebae. Temperature, pulse, and respirations were normal. Scars of previous operation were well healed. Physical examination was otherwise negative.

Stools were examined after admission but no *Endamoeba histolytica* was found. Proctoscopic examination revealed small, oval punched-out ulcers in the mucosa of the rectum and sigmoid. Smears from the ulcers were negative for amebae. Patient was started on chiniofon, 0.25 grams three times a day, to be continued for 10 days. This treatment is being carried out at the present writing.

Comment

This case illustrates several points worthy of comment. On admission, history, physical examination, and laboratory studies including roentgen examination of the chest all pointed to primary intrathoracic disease. Only after repeated and detailed roentgenographic study, coupled with careful evaluation of the patient's clinical signs and course was the underlying hepatic suppuration recognized.

Prompt recognition of emetine toxicity through electrocardiographic study, which led to a stoppage of this drug, probably prevented the patient from developing clinical symptoms of poisoning, such as fall in blood pressure, cardiac irregularity, nausea and vomiting, or peripheral neuritis. However, carbarsone, vioform, chiniofon, or one of the anti-amebics should have been administered during the patient's convalescence from surgery and might have prevented his readmission for recurrence of dysentery.

Case 8 (L. G.).—This 30-year-old, colored male was admitted to the hospital on 26 December 1945 with a chief complaint of dull pain in the right upper quadrant of the abdomen of 2 weeks' duration. The pain was originally severe and sharp in character, with radiation to the small of the back. The pain was increased by motion. It was associated with anorexia, flatulence, belching, and night sweats. There had been no nausea or vomiting and no chills.

The patient had been discharged from the Army approximately 1 month prior to admission but duty stations were not mentioned in the history.

Temperature on admission was 98° F., pulse 120, and respirations 30. Physical examination revealed tenderness and rigidity of the right upper quadrant of the abdomen. Otherwise, it was essentially negative. Total white blood cell count was 13,700 with 82 percent polymorphonuclear cells.

The patient was thought to have an empyema of the gallbladder and was placed on a conservative regimen with penicillin. Stools were studied for ova and parasites but none was found. Abdominal scout film was negative.

By 8 January 1946, the patient was unimproved clinically and temperature and leukocyte counts were higher. The abdomen was opened through a right rectus incision and a large subhepatic abscess cavity of undetermined origin was evacuated of approximately 500 cc. of thick brownish pus. The abscess was drained. Culture of the pus showed no growth.

Initial improvement followed but the wound continued to drain large amounts of thick, reddish brown pus. Temperature began to climb and leukocytosis persisted. On 28 January better drainage was obtained by enlarging the opening under sodium pentothal anesthesia. Temporary improvement was again followed by profuse purulent drainage and temperature rise. Marked destruction and erosion of the wound edges had developed.

Once again the draining wound was enlarged for exploration. An extensive necrotizing process extended from the original incision in all directions. This process involved the skin, subcutaneous tissue, and muscle of the abdominal wall and extended upward over the thoracic cage. Wide incision and excision was practised. Although it was suggested by the operator that the *Endamoeba histolytica* might be etiologically involved in this gangrenous process, it was decided to try zinc peroxide dressings before resorting to emetine therapy. Aerobic and anaerobic cultures of the pus and excised wound edges revealed only an aerobic, coagulase positive, penicillin resistant *Staphylococcus aureus*.

Postoperative improvement was dramatic and progressive. A partial secondary closure was performed on 5 March and healing was complete by 15 April when the patient was discharged from the hospital.

On 15 May 1946 the patient was readmitted to the hospital with fever and a cough productive of pinkish sputum. History of watery diarrhea since previous hospitalization. Temperature on admission was 102° F., pulse 120, and respirations 20. Physical examination revealed moist râles over right middle and lower lobes with slight dullness and increased breath sounds in the same area. White blood cell count was 17,600 with 8 bands and 20 segmented forms.

Roentgenogram of the chest revealed a lung abscess in the apex of the right lower lobe (fig. 4a). Penicillin therapy was instituted. Culture showed *Streptococcus viridans* and *Neisseria catarrhalis* in the sputum. Bronchoscopic examination showed pus coming from the right lower lobe bronchus. Repeated examinations of the sputum and stools for amebae were all negative.

By 27 May the patient had shown little or no improvement on penicillin therapy. Emetine and sulfadiazine were started with almost immediate benefit. A course of carbarsone was given between 7 June and 15 June. Temperature and white blood cell count dropped to normal, cough diminished, and patient's general condition improved. Serial roentgenograms showed progressive changes toward improvement, with decrease in lung reaction around the abscess and shrinking of the cavity itself, until on 29 June only a slight abnormal density remained to mark the site of the lesion (fig. 4b). The patient was discharged at this time, sign and symptom free.

Comment

This case presents several interesting points. Although stools were examined for ova and parasites, the diagnosis of amebic infection was

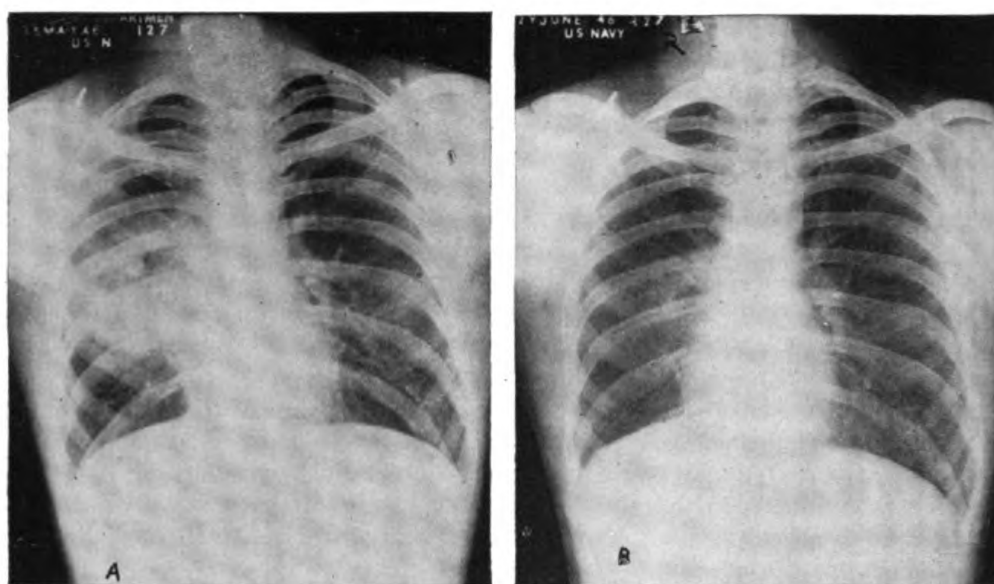


FIGURE 4.—(A) Lung abscess with fluid level located in the apex of the right lower lobe. (B) Same chest approximately 6 weeks later after emetine and carbarsone therapy. Only a slight abnormal density remains to mark the site of previous lesion.

not seriously entertained for some time. The patient was thought pre-operatively to have an empyema of the gallbladder. At operation, the source of the abscess was not determined. The continued profuse drainage and the character of the pus led to a suspicion of liver abscess. The development of the necrotizing abdominal wound infection, which involved the muscle as well as the skin and subcutaneous tissues, pointed to an amebic infection. However, *Endamoeba histolytica* was not demonstrated in the pus or wound edges and response to radical surgery and zinc peroxide dressings was so entirely satisfactory that no more specific therapy was adopted before the patient was discharged.

On the second admission, with the antecedent history at hand, an amebic etiology for the lung abscess was immediately suspected. Examinations of stools and sputum were negative for *Endamoeba histolytica*. However, failure to improve on penicillin therapy with an immediate progressive, and lasting response to emetine and carbarsone lends strong support to our opinion that liver, wound, and pulmonary infections were all complications of an underlying amebiasis.

Case 9 (B. Mc.).—This 37-year-old, white male was admitted to the hospital on 27 December 1945 with chief complaints of cough and weight loss. The patient had returned from the Pacific theater about 2½ months before admission. Shortly thereafter he had developed a cough productive of thick white phlegm and he began to lose weight. He estimated his total weight loss at about 30 pounds. He had experienced occasional sticking pain in the right upper quadrant of the abdomen. Chills and fever developed about 1 week prior to admission. Anorexia was an associated complaint but there was no nausea and vomiting and no diarrhea or history of the latter while patient was in the Pacific area.

Temperature on admission was 100° F., pulse 104, and respiration 28. Physical examination revealed an emaciated, white male obviously acutely ill. Although the patient was somewhat dyspneic, no abnormal chest signs could be demonstrated and there were no other positive physical findings. White blood cell count was 20,700 with 19 bands and 58 segmented forms.

Patient was given supportive treatment and penicillin. Stool examination was negative for ameba. Blood smear was negative for malarial parasites. Patient's course continued septic and his condition became more critical. By 1 week following admission, there was clinical and roentgenographic evidence of pleural effusion on the right. Thoracentesis yielded 85 to 90 cc. of thick reddish pus which showed no growth on culture.

Thoracotomy with rib resection and open drainage was performed on 11 January 1946. The patient's temporary improvement was followed by a rapid downhill course which terminated in death on 16 January.

At autopsy, it was found that the empyema on the right was secondary to a liver abscess which had perforated through the diaphragm. This abscess was one of two located in the dome of the right lobe of the liver. Histological study of sections from the abscess wall showed many amebae. The colon was normal in appearance.

Comment

In the preceding cases, we have seen several examples of fixation and elevation of the diaphragm plus lung and pleural reaction secondary to a liver or subdiaphragmatic abscess. These clinical and roentgen findings may lead to an erroneous diagnosis of primary intrathoracic disease. On the other hand, the liver abscess may perforate the diaphragm and produce a true empyema. This secondary complication may completely overshadow the primary subdiaphragmatic lesion. So it was in this case, and the liver abscesses were not suspected as the etiological factor in the empyema until they were demonstrated at postmortem examination. However, it is improbable that antemortem diagnosis and treatment directed toward the primary disease could have altered the outcome in this patient who was so critically ill and who responded so poorly to treatment of the complicating empyema.

Case 10 (C. C. B.).—This 19-year-old white male was transferred to this hospital from another naval activity on 13 March 1946 with a history which may be summarized as follows:

1. Ruptured appendix with appendectomy and drainage—31 January 1945.
2. Subphrenic or hepatic abscess drained through a laterally placed, right abdominal incision on 5 March 1945. Wound healed in April 1945.
3. Abscess redrained through previous incision—20 May 1945.
4. Rib resection and drainage of empyema on the right—1 August 1945. Developed bronchopleural fistula.
5. Thoracostomy wound revised for better drainage—17 October 1945. Continued drainage of yellow pus to date in spite of repeated courses of penicillin and sulfadiazine.

The following studies were performed following admission to prove the existence of a bronchial fistula and to determine the course and extent of the tract:

1. Inhaled smoke did not exit through the draining wound in the chest

2. Lipiodol injection of the fistulous tract under fluoroscopic observation showed an extension centrally for about 6 inches and then downward through the diaphragm into a cavity located in the anterior aspect of the right lobe of the liver (fig. 5).

3. Bronchoscopic instillation of lipiodol into both lower lobe bronchi revealed a normal bronchial tree on the left and slight puddling of the opaque medium in the region of the anterior portion of the lower lobe on the right. There was no demonstration of the tract extending below the diaphragm on this examination.

4. Gentian violet injected into the fistulous tract was expectorated shortly thereafter, finally proving the existence of the bronchopleural communication.

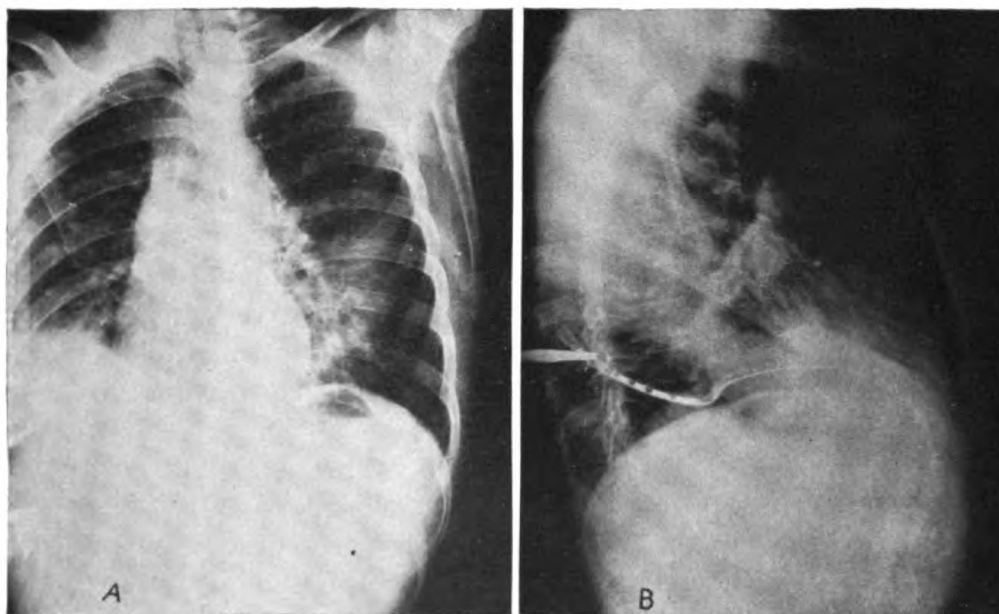


FIGURE 5.—Lipiodol injection through catheter in bronchopleural fistula. (A) and (B) show puddling of the lipiodol in the abscess cavity which is located in the anterior aspect of the right lobe of the liver.

On 30 April operation was performed. The fistulous tract in the right chest wall was excised down through the bony cage. Regenerated ends of the eighth rib were resected for better exposure. The granulation-lined tract within the chest was explored to the point where it perforated the diaphragm to end in a large abscess cavity. The intrathoracic tract was packed with iodoform gauze. An incision was made directly over the liver abscess anteriorly. A portion of the sixth rib and costal cartilage was resected and the abscess cavity was unroofed. Foul-smelling pus and shaggy granulation tissue were evacuated and the cavity was packed with iodoform gauze and drained. Culture of the pus showed alpha hemolytic streptococcus. No attempt had been made to demonstrate or close the bronchial opening as it was felt that this would heal spontaneously with the establishment of adequate drainage.

The patient improved steadily after operation. Cough and sputum decreased. The original lateral chest sinus filled in to complete closure by 31 July. The anterior wound over the liver abscess cavity was still open at this date. Drainage was minimal. Gentian violet and lipiodol injections and the smoke test all failed to demonstrate any persistence of the bronchial fistula.

Comment

This case presents the complete picture of the pyogenic liver abscess. The primary infection was in the appendix. The complicating liver abscess was correctly diagnosed but apparently inadequately drained. It perforated the diaphragm, producing an empyema which in itself was complicated by the development of a bronchial fistula. Surgery at the present admission was directed primarily toward securing adequate drainage of the persistent liver abscess. The result to date, with spontaneous closure of the bronchial fistula, again emphasizes the importance of this fundamental consideration in the treatment of purulent collections wherever located.

SUMMARY AND CONCLUSIONS

Ten cases of liver abscess which were treated on the surgical service at this activity in a period of 5 months have been presented for study.

The group as a whole is indicative of the increased frequency with which we may expect to encounter this condition.

Individually, the cases illustrate many of the problems in diagnosis and treatment and several of the complications of liver abscess.

Seven of the ten cases were correctly diagnosed preoperatively, two were operated as acute gallbladders, and in one case the diagnosis was made on postmortem examination. Roentgenological aid to diagnosis was invaluable.

In nine of the cases, the abscesses were treated surgically, and once adequate open drainage had been established healing was prompt and uneventful. There were no deaths in this group.

Three of the cases in whom an amebiasis was suspected as the etiological factor returned with further complications attributed to this disease. It is entirely possible that had more intensive treatment of the underlying amebiasis with emetine and carbarsone been combined with the entirely satisfactory treatment of the complicating liver abscesses, those recurrences might have been prevented.



HEPATIC AMEBIASIS¹

HAROLD J. F. KULLMAN²

Captain (MC) U. S. N. R.

and

HOWARD GOLDEN, M. D.³

TODAY as never before clinicians should forever be on the alert for evidence of latent amebiasis, particularly with hepatic involvement, and include it in their differential diagnosis of unexplained fever. It merits greater attention than usual because of the large number of military personnel who have returned to civilian life, after having been in areas known to have a high incidence of the disease. Involvement of the liver occurs with greater frequency in amebiasis than any organ other than the colon.

The clinical manifestations of this complication may develop during, immediately after, or years after the acute intestinal amebiasis and also in persons who cannot give a good history of previous acute dysentery. Galloway (1) states that cases are recorded of amebic hepatic abscess 20, 30, and 43 years after dysenteric symptoms. Interestingly, many patients cannot give a good history of acute manifestations of the original parasitic infestation. Craig (2) mentions the fact that strains from carriers frequently gave a higher pathogenic index than the strains from an acute case of amebic dysentery. It has been suggested that influence of bacteria occurring in the intestine along with *Endamoeba histolytica* may explain some of the clinical differences observed in infestations with this parasite.

Irrefutable diagnoses of hepatic amebiasis cannot be made in the absence of parasitologic evidence. Location and extent of the hepatic lesions cannot be made with accuracy. Payne (3), Gaubenhaus, and Pfanner report negative or insignificant stool findings are the rule in known cases of amebic hepatitis before diagnosis and treatment or death. One of the above reported 11 percent positive stool findings in hepatic amebiasis. Another factor in positive stool findings is technique used and the ability of the examiner of the stool specimen or proctoscopic scrapings. Sodeman and Lewis (4) warn if one waits until the criteria for diagnosis are absolutely fulfilled, great hazard

¹ From the Medical Service, Veterans' Administration Hospital, Dearborn, Mich.

² Chief, Medical Service, Veterans' Administration Hospital, Dearborn, Mich.

³ Gastroenterologist, Veterans' Administration Hospital, Dearborn, Mich.

is added to the life of the patient and potential benefits from treatment are greatly reduced. Frequently, the admission diagnosis is one of many other conditions. Most of our cases had been treated for malaria prior to hospital admission. Pleurisy and pneumonia, because of symptomatology and positive roentgen findings, are also frequent admission diagnoses. When presenting symptoms are upper abdominal in character, acute cholecystitis, acute pancreatitis, and sub-acute penetrating peptic ulcer with peritoneal irritation may confuse the clinician or surgeon. Walters, Watkins, Butt, and Marshall (5) point out the diagnostic dilemma frequently encountered in their report of two cases of amebic hepatitis where rupture into the pleural cavity occurred unsuspected in patients hospitalized for other conditions.

The high mortality rate experienced in the Chicago epidemic of 1933 reemphasized the necessity of constant reeducation of physicians in temperate climates with the seriousness of this disease entity. Prevalence of amebiasis varies, but Faust (6) in 1942 calculated the over-all incidence may average 20 percent of the general population. Nobody knows what the incidence at present is with the many thousands of returned servicemen who served in dysentery areas. The Mayo Clinic reports cases of amebiasis found in people from every State, and it has also been noted that high incidence occurred in northerners during epidemics where mixtures of people from southern and northern States were involved.

Physicians in military service have developed a singular respect for the serious character of the disease and the difficulty attendant to the diagnosis of the disease and its complications. It has been the experience of one of us overseas in World War II to see cases on the medical wards with positive malarial smears following chills and fever develop acute abdominal catastrophic pain following failure of antimalarial therapy with proved hepatic amebiasis on later investigation. These cases responded dramatically to amebicide therapy and surgical drainage was obviated.

The purpose of this paper is merely to call attention to the many physicians in the northern states of the necessity to carefully watch for carriers with or without mild symptoms, and to intelligently treat them when found. This will reduce the incidence of hepatic amebiasis because no one knows as yet what "sets off" the process which results in hepatic involvement. Immunity that the carrier may retain for a long period of time is occasionally suddenly lost years later. Intercurrent infection, dietary indiscretion and surgical trauma are some of many reasons given for loss of this immunity. Absence of previous diarrhea, and negative stool and proctoscopic studies should not deter one from making this diagnosis.

PATHOLOGY

The term hepatic amebiasis is not new, but it well covers the two arbitrary terms, namely, amebic hepatitis and amebic abscess of the liver. It would be most difficult to differentiate the invasive stage of the ameba and the attendant degree of hepatic changes and call it hepatitis from the various stages of acute, subacute and chronic abscess of the liver.

Based on collected fatal cases of amebic dysentery, Ochsner and DeBakey (7) in 1943 found amebic abscess in 36.6 percent. Craig in 78 fatal cases of amebic dysentery observed at autopsy reported 33 percent had liver abscess, both single and multiple involvement being noted. He also states the ancient idea that "amebic abscesses of the liver is usually a solitary abscess is most erroneous."

The pathology in the liver varies depending on the stage of the process and also if secondary infection is present or absent.

There are three possible routes of invasion by the ameba :

1. Direct extension through the bowel wall, peritoneal cavity, and capsule of the liver. This may occur in cases having enlarged tender livers with subhepatic signs and no elevation of the diaphragm or secondary pleuropulmonary signs.

2. Extension by the lymphatic route, believed by most observers the rarest method of spread.

3. Extension from the bowel through tributaries of the portal vein, believed the most common method of extension. In the development of amebic hepatitis and abscess, two factors probably play prominent roles. The organisms may lodge in the smaller portal radicals producing areas of infarction and focal necrosis, or by actual cytolytic action of the ameba, liquefaction of the plugged vessel and hepatic cellular elements may occur. Contents of typical hepatic amebic abscess is anchovy sauce or chocolate sauce in character, and when secondary invading organisms are present, becomes purulent in character.

The character of the abscess wall is typical in those abscesses in which *Endamoeba histolytica* is the sole cause and the characteristic shaggy appearance of the lining cavity is largely due to the fact that the connective tissue of the liver offers a marked resistance to cytolysis and that invasion of tissue by this parasite stimulates connective tissue formation. In small abscesses there is frequently no distinct abscess wall macroscopically and in pure amebic abscesses, no pyogenic membrane is present as in abscesses caused by bacteria. At times all that remains of original liver structure are strands of the cytolytic resistant connective tissue giving a shaggy appearance. Small, localized, fibrotic areas in the liver of patients having had amebic dysentery may represent aborted abscesses and indicate the organ is resistant and will survive spontaneously or following adequate treatment.

Amebae are difficult to find in the abscess contents and are usually demonstrated in the periphery of an abscess wall or zone of hyperemia immediately adjacent the wall.

SIGNS AND SYMPTOMS

Elsom, Rogers, and Wood (8) describing their experience in an Army hospital in India, emphasize the need for early recognition of amebic hepatitis; in their series of cases 30 were so diagnosed.

The prominent symptoms were abrupt in onset, developing in two distinct groups, one being those in whom it was incidental to the course of amebic dysentery, and the other being the group in which hepatitis was the primary and outstanding clinical picture. They were equally divided, 15 of each.

Intense pain in the right upper abdomen, epigastrium, or lower right chest was the most frequent initial symptom. Pain is frequently accentuated on deep inspiration and may be referred to the right shoulder. History of chills and fever is common. When diaphragmatic extension occurs, early pleuropulmonary signs may overshadow any of the abdominal signs or symptoms. An enlarged tender liver or at times a mass with or without right rectus spasm may be presenting physical findings. Perhaps the easiest way of eliciting this is by bimanual compression over the lower right bony thorax.

Jaundice is notoriously absent unless an abscess be large and compressing the larger biliary radicals. Liver function studies are not very helpful. Temperature of 101° F. to 104° F., with or without chills, and leukocytosis from 14,000 to 25,000 are commonly present. Mild anemia may occur.

Often stool examinations are not helpful enough. Elsom, Rogers, and Wood found positive evidence in only 4 of their 30 cases. In addition, decisions regarding treatment are not compatible with intensive, long-continued stool studies, and cathartics are contraindicated many times.

Positive radiological evidences are helpful only 50 percent of the time.

Many times emergencies such as perforated peptic ulcer, acute cholecystitis with or without rupture, acute pancreatitis, ruptured viscus, and acute appendicitis must be ruled out.

It usually requires 3 days to evaluate results of medical therapy, although subjective improvement may be noted by the patient in 24 hours.

Improvement is usually prompt and unmistakable. The patient has a sense of well-being and a subsidence of pain before becoming afebrile. Decrease in size of the liver is slower than the disappearance of liver tenderness.

We wish to emphasize the absence of trophozoites and cysts on stool examination, and absence of ulceration on proctosigmoidoscopic examination does not rule out the presence of hepatic amebiasis.

The history of associated malaria in the past and presence of positive malarial blood smear with failure of patient to respond to anti-malarial therapy should lead one to suspect hepatic amebiasis as probably coexisting.

Failure to respond to penicillin therapy with or without sulfonamide in the presence of signs pointing to acute liver disease with or without jaundice, with leukocytosis and chills and fever are highly suggestive of hepatic amebiasis and a therapeutic trial of emetine should be given, particularly, if the patient has been in well-known amebic endemic areas in the past.

Snell (9) states, "For every case in which the diagnosis is made by finding the *Endamoeba histolytica* in the stools, there is one in which the diagnosis is made by observing the therapeutic effect of emetine."

In hepatic amebiasis too often the past history of dysentery is absent and the diarrhea too mild to attract attention. Craig believes in a high incidence of previous dysentery and states that 85 percent of cases of amebic hepatic abscess gave history of preceding amebic dysentery.

Rupture of amebic abscess of the liver occurs when unrecognized into the right pleural cavity, the pericardium, the right lung (usually with an already adherent pleura) and less commonly into the colon, kidney, bile duct, stomach, and lumbar muscles.

X-RAY

As in the clinical picture, difficulty is also encountered in x-ray findings of hepatic amebiasis. Direct radiological signs are very limited and one is limited to the indirect signs of the right half of the diaphragm and the right lower lung field. These are produced by upward enlargement of the liver either by generalized enlargement or localized bulging, extension through the diaphragm producing amebic pleuritis, and later manifestation, pleuropulmonary amebiasis usually with abscess formation.

Gas, if present in the abscess cavity of the liver, is helpful but is a late manifestation and means secondary invading organisms are present. Calcific changes in the encysted abscess wall are very late changes rarely encountered and of little value in acute and subacute hepatic amebiasis.

Munk (10) classifies radiological signs as:

Group I.—Includes cases in which no radiological signs in the diaphragm can be expected. True, the right lobe is most frequently involved and particularly the superior surface, thus accounting for

early signs. Multiple lobe involvement does occur and if the lower anterior portion of the right lobe is the major site or the lesions remain intrahepatic or subhepatic, x-ray evidences may be negative.

Group II.—Cases showing varying degrees of elevation of the diaphragm due to enlargement of the subphrenic part of the liver as part of generalized enlargement or due to a localized subphrenic enlargement with various degrees of restricted or abnormal movements and pathological changes in the right lower lung field.

TREATMENT

Treatment of hepatic amebiasis depends on the earliest possible recognition and one should hope to start during the stage known as hepatitis. Once large abscess formation with impending rupture occurs, medical treatment may fail or only partially produce regression of symptoms and physical findings. If decision to aspirate is made, the medical treatment with emetine before and after aspiration is both desirable and necessary.

During the course of treating successfully on a medical regime, six cases reported in this article, two additional cases of hepatic amebiasis with large abscess and impending rupture were surgically drained following preoperative emetine therapy and repeating emetine during the postoperative course. Additional medical treatment during convalescence included carbarsone and diodoquin to treat adequately the intestinal phase.

As shown by Rogers and Craig, there is a period during the evolution of an amebic abscess of the liver in which more or less characteristic symptoms may be recognized and proper treatment may result in aborting of abscess formation or even if the abscess has formed may result in its healing without the necessity of resorting to serious surgical measures.

Following recognition, the daily subcutaneous injection of 1 grain of emetine hydrochloride for a period of 10 days usually brings regression of temperature in 3 to 7 days, but a slower drop in leukocytosis and sedimentation rate. Repeating, at least once, the course of emetine after a rest period of 2 or 3 weeks is recommended. A course of carbarsone and diodoquin during the rest period is advisable. Electrocardiographic studies should be carried out during the course of emetine therapy, as it was necessary to cut short the 10-day course in two instances in this short series due to conduction and T-wave changes.

Case 4, which presented findings simulating acute cholecystitis and a surgical abdomen without elevation of the right diaphragm, was interpreted as representing primary left lobe involvement. Some writers feel that such cases should be treated with open operation.

Similar cases reported in the literature were treated surgically, but diligent medical management may suffice as demonstrated here.

Case 5, which represents one of extensive spread to the perinephric area and invasion of the lumbar muscles on the right side, is most unusual and presents a definite diagnostic dilemma. Pleuritis, elevation of the diaphragm, and an adhesion demonstrated following recovery by diagnostic pneumoperitoneum undoubtedly represents multiple lobe involvement and probably multiple abscesses in more than one lobe. If such a case were attacked surgically after emetine therapy, aspiration or open drainage would be most difficult and inadequate.

Ross (11) in 1944 reported a case of amebic perinephric abscess which displaced the right kidney anteriorly and laterally. The right psoas muscle line was obliterated and dye was observed escaping into a ragged cavity on retrograde study. Treatment was medical with emetine, and check-up later showed a normal kidney outline and pyelogram.

Ochsner and DeBakey in 1943 reported improved mortality rate of 22.1 percent in 80 cases to 3.6 percent in 83 cases following change from emetine and open drainage to emetine and repeated aspiration.

The elimination of the intestinal infection with this parasite is also an important part of the treatment of hepatic amebiasis. We have followed emetine therapy with courses of carbarsone and diodoquin in the six cases of hepatic amebiasis treated medically and had one patient return for a complete course of therapy including emetine because of persistent moderate leukocytosis and elevated sedimentation rate. He had no complaints and felt well. Both laboratory findings returned to normal following this subsequent course of therapy.

Case 6 emphasizes the need for the elimination of the intestinal infection or more intensive treatment postoperatively. This patient had open surgical drainage of a typical amebic liver abscess followed by one course of emetine in another hospital. Symptoms disappeared and clinical and laboratory findings returned to normal with adequate follow-up of emetine, carbarsone, and diodoquin.

The follow-up study in both surgically and medically treated hepatic amebiasis is very necessary to prevent recurrence and also to take care of the multiple lobe involvement should one choose to aspirate or drain surgically.

In spite of Ochsner and DeBakey's improved statistics with aspiration plus emetine therapy, Ferguson and Anderson (12) advocate surgical drainage in reporting four cases so treated. Two of these cases were diagnosed as acute gallbladder disease and infected pancreatic cyst preoperatively. These were cases in service personnel, and further emphasize the need of considering the possible hepatic amebiasis in ex-military personnel.

Warshawsky, Nolan, and Abramson (13) reported five cases occurring in a Veterans' Administration Hospital among returned military personnel, two of whom were explored and all recovered. They anticipate an increasing frequency in the next few years.

CASE REPORTS

Case 1.—D. F. T., the patient was a 26-year-old white veteran who served for 2½ years in the China-Burma-India theatre and was discharged from military service on 19 Oct. 1945. He had no history of illness during his service. Three weeks following discharge from the Armed Forces in November 1945, he began having pains in the lower right chest, associated with fever and profuse diaphoresis. He consulted his local physician who diagnosed his condition as pleurisy and instituted treatment. He began losing weight and continued to go downhill. He was admitted to this hospital on 1 Mar. 1946, complaining of severe anorexia, pain in the lower right chest, 20-pound weight loss and generalized weakness. No definite history of diarrhea could be elicited.

Physical examination revealed a malnourished male appearing chronically ill. Weight was 125 pounds, temperature 99° F., pulse 110, and blood pressure 108/72. Limited expansion of the chest on the right side with definite dullness to percussion was elicited over the lower right chest posteriorly, and breath sounds were diminished. A very tender liver edge was palpable two finger-breadths below the right costal margin.

Laboratory findings included white blood count of 19,750 with 69 percent polymorphonuclears and eosinophils of 5 percent. Sedimentation rate was 26 mm. and hemoglobin was 13.5 grams. Other laboratory examinations consisting of urinalyses, smears for malaria, Wassermann, cephalin flocculation, bromsulfalein, serum bilirubin, multiple stool examination, and agglutinations for typhoid, paratyphoid, and brucellosis were all negative.



FIGURE 1.—Case 1. Chest x-ray taken on admission.

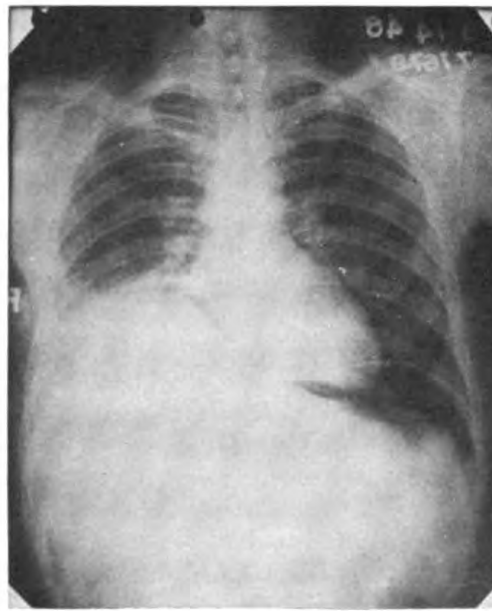


FIGURE 2.—Case 1. Pneumoperitoneum before therapy.

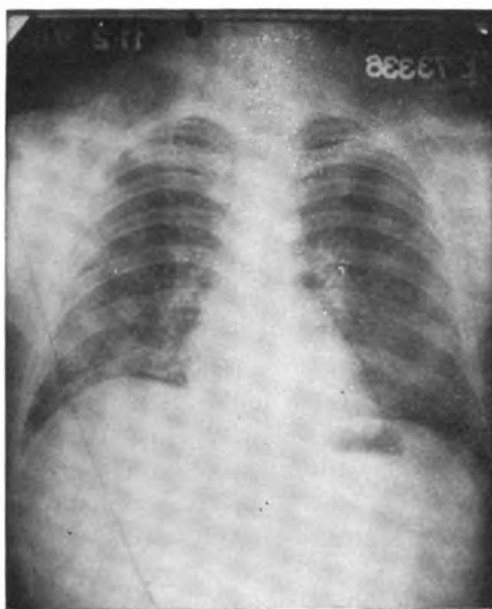


FIGURE 3.—Case 1. Final chest x-ray following therapy.

Sigmoidoscopic examination with the scope passed 25 cm. was essentially normal, and smears examined for trophozoites and cysts were negative.

X-ray of the chest showed right leaf of the diaphragm elevated and a thickened pleura of the right base. Pneumoperitoneum demonstrated perihepatic adhesions of the outer half of the right diaphragm.

With history of this patient having been in an endemic area, having pain and tenderness over the liver, leukocytosis, fever, elevation of the right leaf of the diaphragm, a diagnosis of hepatic amebiasis was entertained and treatment instituted. It should be noted that during the course of work-up, penicillin, 30,000 units, every 3 hours around the clock, was given with no effect on temperature levels.

Emetine hydrochloride, grain 1 (0.06 gram) was given subcutaneously on 8 successive days. Temperature which had been running between 99° and 102° F. dropped to normal within 48 hours. Pain in the right upper quadrant disappeared in 48 hours, and patient was subjectively much improved. After emetine, he was given diodoquin in doses of 9.6 grains or 0.63 gram (three tablets of 3.2 grains or 0.21 gram each) 3 times a day for 14 days. Following this a second course of emetine grain 1 subcutaneously for 7 days and carbarsone capsules 3¾ grains or 0.25 gram 3 times a day for 7 days was given. At the completion of this therapy, hemoglobin was 15 grams; white blood count 13,950; polymorphonuclears 48 percent; eosinophilia 16 percent; and sedimentation rate 6 mm.

Patient was symptom-free and had regained 20 pounds in weight which was lost prior to admission. He remained symptom free and final check-up demonstrated a normal chest x-ray several months later. The final blood count showed 15 grams hemoglobin; white blood count 6,000; no eosinophilia; and a sedimentation rate of 4 mm. Surgical procedures were obviated.

Case 2.—J. T. L., a 21-year-old white male veteran was discharged from service on 1 June 1946 following duty in the Southwest Pacific, and entered this hospital 11 December 1946. Four days prior to admission, he developed pleuritic type of pain in the right lower chest and pain in upper abdomen associated with chills and temperature of 103° F. Appetite had been poor for 6 months, and he had lost 25 pounds in weight. Cough was present for 1 week, and he was constipated. No definite history of diarrhea could be elicited. Prior to admission he had seen a local physician who diagnosed his condition as bronchitis and instituted treatment, following which he was told that he had pneumonia and was given a course of penicillin without subjective improvement.

Physical examination revealed pulse to be 100, temperature 101° F. and respiration 24. Respiratory excursion of the lower right chest was limited, and there was tenderness to palpation in the right upper quadrant. There was compression tenderness over right lower ribs. White blood count was 27,450 with 88 percent neutrophils. Temperature varied from 99° to 103° F. with chills.

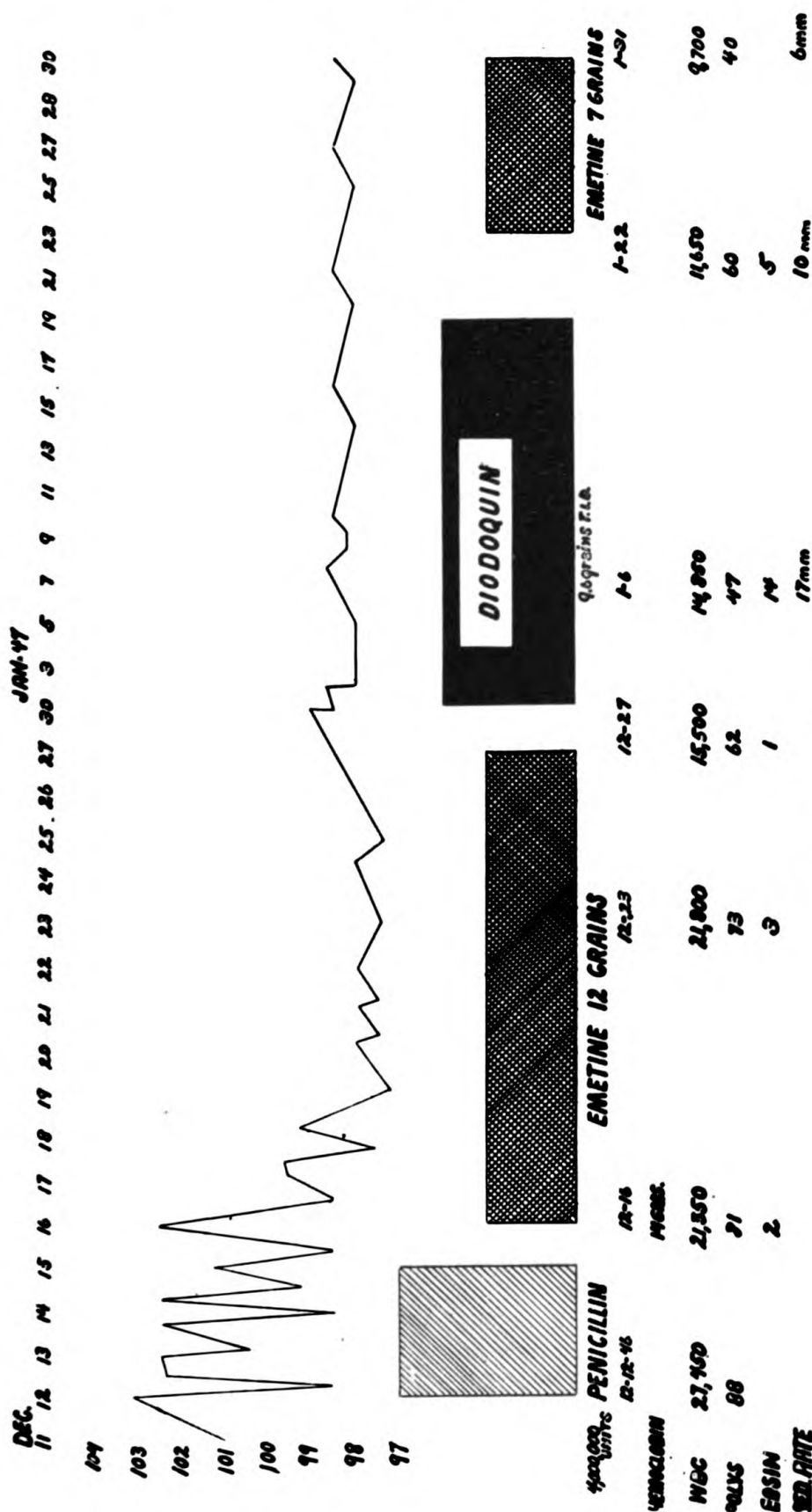


FIGURE 4.—Case 2.

Repeated stool examinations were negative as were direct smears on proctoscopy.

Laboratory examinations including bromsufalein, total serum protein, and A-G ratio, serum bilirubin, Wassermann, smears for malaria, agglutination tests for typhoid, paratyphoid and brucellosis, urinalyses, sputum examinations, and blood cultures were all negative.

X-ray showed some thickening of the costophrenic angle on the right side with increased density. Fluoroscopy revealed a fixed right leaf of the diaphragm.

During investigation penicillin 30,000 units every 3 hours around the clock was given without effect. A diagnosis of hepatic amebiasis was then entertained and treatment instituted. He was given 1 grain emetine subcutaneously for 12 days with dramatic improvement. After 72 hours his temperature returned to normal, liver tenderness and muscle spasm diminished, and a remarkable sense of well being existed. Following this, a course of diodoquin consisting of 9.6 grains 3 times a day was given for 21 days, and finally 1 grain emetine for 7 days. Reference is made to figure 4.

Upon discharge patient had a white blood count of 9,700 with a sedimentation rate of 6 mm. To date he has remained in good health. Surgical procedures were obviated.

Case 3.—M. M., a 40-year-old-colored male veteran was discharged from the armed forces December 1945 after serving in North Africa, Italy and the Philippines. He entered this hospital in May 1946 with chief complaints of pain in the right shoulder region associated with chills and fever which had been present off and on since January 1946. Appetite was poor, and a weight loss of 20 pounds occurred since the onset of his illness. A definite history of diarrhea could not be elicited.

Positive physical findings were an area of flatness in the right base extending to the level of the eleventh rib posteriorly and the third rib anteriorly; spasm and tenderness over the abdomen, especially marked in the right upper quadrant; and a liver edge was not definitely palpable. White blood count on admission was 22,000 with 72 percent neutrophils; sedimentation rate 33 mm.; and hemoglobin 10 grams. Bromsulfalein, serum bilirubin, urinalyses, Wassermann, agglutinations for typhoid group and brucella, smears for malaria, sputa examinations, serum proteins, albumin globulin ratios and cephalin flocculation tests were all within normal limits. Numerous stool examinations were negative. The proctoscopic with immediate smear for trophozoites and cysts was negative. Temperature was 101° F. Blood pressure was 140/80. Pulse was 100, and respirations 20. X-ray of chest showed marked elevation of the right diaphragm.

Again because of this patient's history of having been in an endemic area, pain in the right upper quadrant associated with leukocytosis and fever, and marked elevation of right diaphragm, a diagnosis of hepatic amebiasis was made and treatment instituted. He received 1 grain emetine



FIGURE 5.—Case 3. Chest x-ray on admission.

subcutaneously for 8 days. Temperature returned to normal after the second day, and the muscle spasm and pain in right upper quadrant likewise regressed. A course of carbarsone was given and a second course of emetine deferred because of electrocardiographic changes. Diodoquin was then given for 2 weeks; at this time a repeat electrocardiogram showed a normal curve.

Therapeutic leave was instituted, but treatment was not considered adequate because of residual leukocytosis, elevated sedimentation rate, and residual roentgen findings. A subsequent course of emetine was then given while under further hospital observation. The white blood count returned to 8,900 and sedimentation rate was 10 mm. The final x-ray examinations were entirely negative. Emetine again produced electrocardiographic changes which are being reported in a separate study. Surgical procedures were obviated.

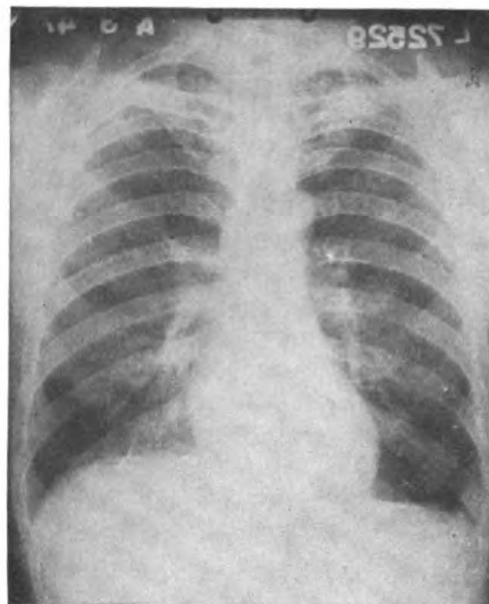
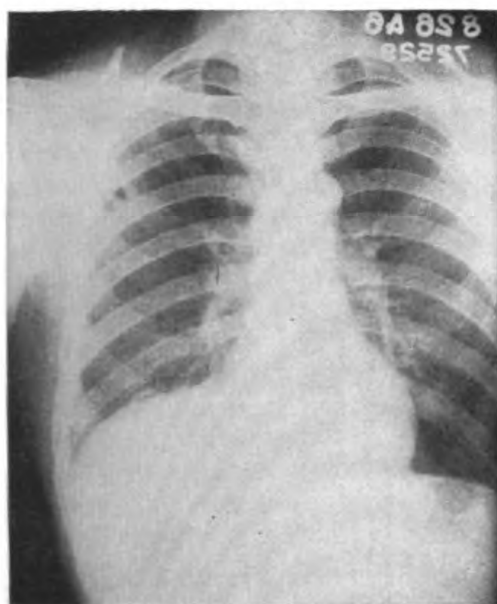


FIGURE 6.—Case 3. During therapy. FIGURE 7.—Case 3. Final chest x-ray.

Case 4.—A. B., a 31-year-old white veteran, served overseas in India for 9 months, and was discharged from service on 3 January 1946. He entered the hospital on 9 October 1946 with complaints of chills, fever, and night sweats for the past 3 months. Onset of symptoms was in July 1946 when he developed chest pain which radiated to the right shoulder. He had chills three to four times daily followed by profuse diaphoresis. Appetite was poor and weight declined 22 pounds in 3 months. He also had periodic, mild diarrhea which lasted for about a day and consisted of about 3 to 4 loose bowel movements and which was present off and on since onset of illness. Antimalarial therapy had been received without effect.

Physical examination revealed an exquisitely tender liver two finger-breadths below the right costal margin plus muscle spasm of the upper right rectus. There were diminished breath sounds and some impaired resonance at the right base. Blood pressure was 100/64. Respirations 20. Temperature varied from 100° to 104° F. with numerous chills. Sedimentation rate was 20 mm. White blood count was 15,000 with 80 percent neutrophils and 12.5 grams hemoglobin. Brom-sulfalein showed 20 percent retention after 45 minutes. Smears for malaria, frequent stool examinations, and proctoscopic smears were negative. Wassermann, blood cultures, urinalyses, agglutination tests for typhoid group and bru-

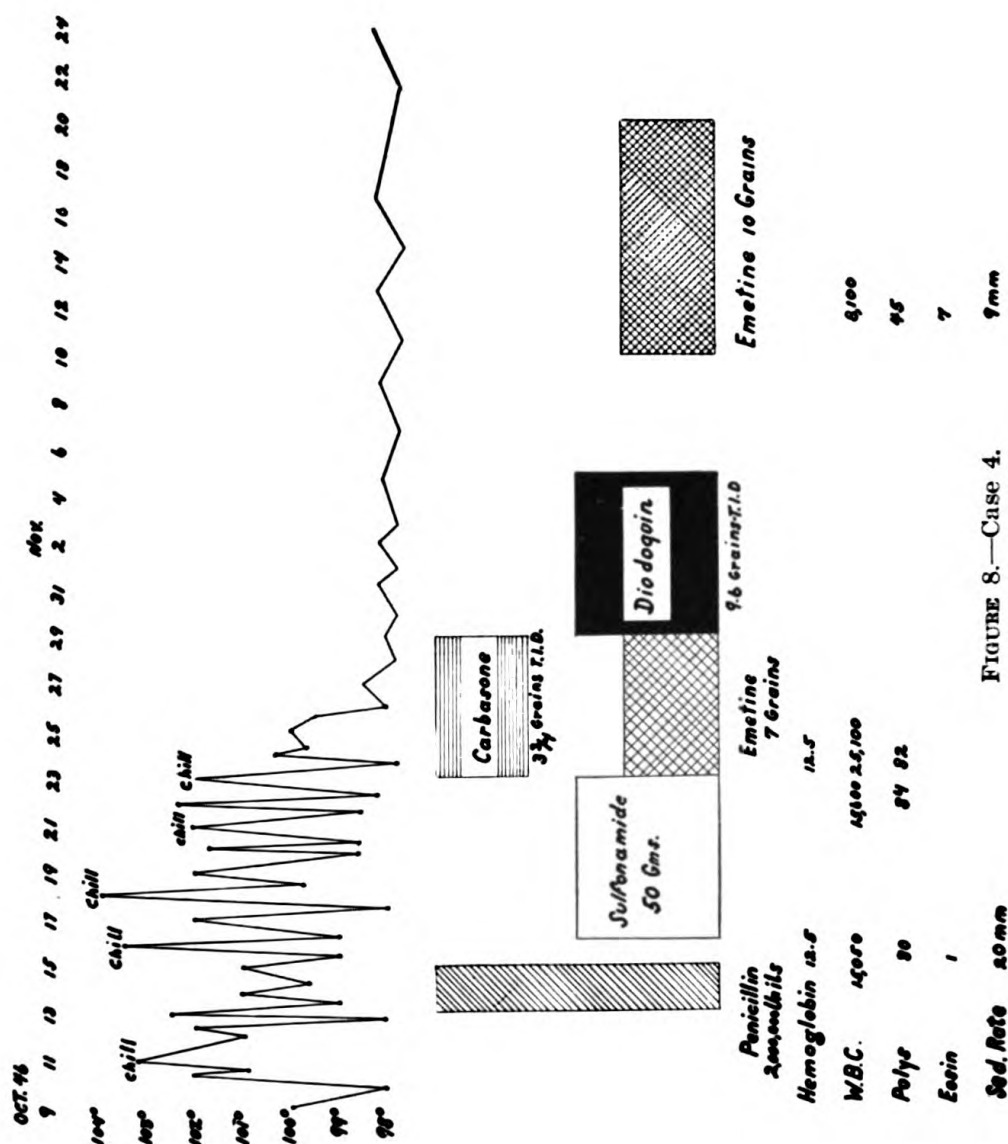


FIGURE 8.—Case 4.

cella, serum bilirubin were all negative. X-ray examination findings of the chest were negative. A diagnosis of hepatic amebiasis was made and treatment instituted. Reference is made to figure 8. Penicillin therapy before emetine was without effect.

One grain emetine hydrochloride was given subcutaneously for 8 successive days, plus carbarsone $3\frac{3}{4}$ grains orally 3 times daily with dramatic improvement. Temperature remained normal after 48 hours. Pain, tenderness and muscle spasm in right upper quadrant was also materially reduced in the same period of time. Following this he was given diodoquin 9.6 grains 3 times daily for 14 days, and then a second course of 1 grain emetine subcutaneously for 7 more days.

On discharge patient felt perfectly well. White blood count returned to 8,000; sedimentation rate was normal; and he had gained 15 pounds in weight. Brom-sulfalein test was normal. To date patient has remained in good health. Surgical drainage and aspiration were obviated.

Case 5.—H. S., a 23-year-old white male veteran was discharged from the service 4 December 1945 after having served overseas in the Southwest Pacific, and was admitted to this hospital on 29 March 1947.

Chief complaint on admission was pain on the right side of the abdomen and back of 2 weeks' duration. This was associated with nausea and vomiting. In June 1945 he first developed slight pain on the right side in the region of the gallbladder. In July 1945 while he was on board ship coming back to the States he had fever, chills, and general malaise which lasted for 3 days. In August of 1945 while on leave he again had pain in the right upper quadrant and stayed in bed for 15 days. In September 1945 he was hospitalized at a naval hospital for 8 weeks at which time a diagnosis of gallbladder disease, pleurisy, and malaria were considered, but no definite diagnosis was established. In December 1945 he was discharged from the Marine Corps. In February 1946 he again began having pain in the right upper quadrant and right lumbar region. He was hospitalized for 5 weeks, until 5 March, at a private hospital, during which time no definite diagnosis was made.

On 15 March, about 2 weeks prior to admission he developed pain in the right side just below the right costal margin. There was nausea and loss of appetite. He then went to his local doctor who put him to bed. While in bed he developed soreness in the right lumbar region. As he had no relief, hospitalization was advised and he entered this hospital on 29 March 1947.

Physical examination revealed a well-developed and nourished, adult, white male appearing acutely ill. There was a moderate amount of lag of the right chest on inspiration. There was decrease in tactile fremitus and vocal fremitus at the right base. Some dullness was present at the right base with decreased breath sounds. Blood pressure was 130/80, pulse 120, respirations 24, and temperature 101° F. On palpation of the abdomen, there was tenderness and rigidity in the right upper quadrant and in the right lumbar region. Liver edge was questionable about three to four finger breadths below the right costal margin.

White blood count was 21,400 with 74 percent neutrophils and 11.5 grams hemoglobin. Repeated stool examinations were negative, as were proctoscopic examinations. Agglutination tests for brucellosis and typhoid group were all negative. Liver function tests were normal. Sedimentation rate was 22 mm.

X-ray showed elevation of the right leaf of the diaphragm with obliteration of the right costophrenic angle. Pneumoperitoneum was done and showed adhesions to the right leaf of diaphragm. These adhesions were posterior and it was felt that perhaps besides liver involvement there was perinephric involvement. Intravenous and retrograde pyelograms demonstrated an area of increased

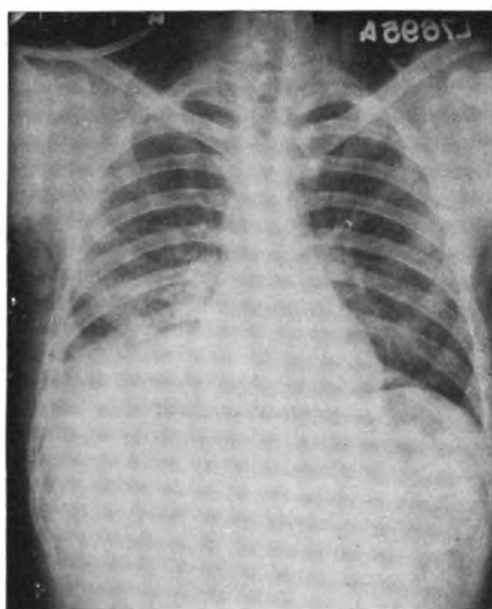


FIGURE 9.—Case 5. Chest x-ray taken on admission.

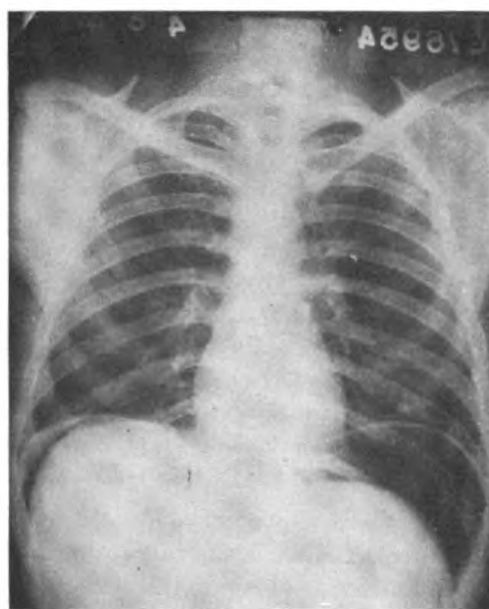


FIGURE 10.—Case 5. Pneumoperitoneum after first course of emetine.

density in the region of the lower pole of the right kidney in addition to obliteration of the right psoas shadow. Complement fixation test for amebiasis was positive. It was thus decided the patient had hepatic amebiasis with probable extension to the perinephric space and lumbar muscles. It is significant that the first few days during the course of work-up, he received penicillin with no effect. On the fifth day of hospitalization, a course of emetine was ordered consisting of 1 grain intramuscularly daily for 9 days. Within 48 hours after emetine, temperature returned to normal and remained so. Pain was much lessened in right upper quadrant and right lumbar area. Because of perinephric involvement it was considered advisable to continue penicillin along with the emetine because of probable secondary invaders. After 9 days of emetine, white count was 8,900 with 52 percent neutrophils. Urinalysis was negative. Repeat retrograde and intravenous pyelograms 7 weeks following admission showed a normal right kidney outline and a normal right psoas shadow. The patient was asymptomatic and had regained weight to normal. Surgical drainage or aspiration had been obviated.

Case 6.—J. S., a 23-year-old veteran, was discharged from the service 24 January 1946 after having served overseas in the Southwest Pacific, and entered this hospital on 8 March 1947.

He was perfectly well until January 1946 at which time he noticed dull pain in the upper abdomen. At the time of his discharge from military service he began having anorexia and pain in upper part of the abdomen which was cramping in nature. He was treated for malaria because of temperature swings to 105°F. without response.

He was admitted to a hospital in Michigan on 6 February 1946 and treated as a perforated appendix. White blood count was 24,000. Two weeks later his appendix was removed, and no evidence of perforation or abscess was noted. Two months after his discharge from the hospital he began having night sweats and sharp constant pain in the right upper abdomen. He again noticed chills and fever. In July 1946 he was again hospitalized and a diagnosis of sub-

phrenic abscess was made. Incision and drainage produced "brownish pus." During this time the patient had been receiving penicillin with no effect. The day following drainage of the abscess he was started on emetine and given 1 cc. daily for a period of 1 week.

In March 1947, prior to admission to this hospital, he again began having chills and fever. At this time he had diarrhea. He was given emetine, 1 injection daily for 5 five days. Forty-eight hours after beginning emetine therapy, fever subsided and diarrhea also disappeared. His private physician then recommended that he be hospitalized at the Veterans' Administration hospital in Dearborn, which was effected on 8 March 1947.

Physical examination revealed a well-developed and nourished adult white male appearing acutely ill. A healed incision about 6 inches long at the level of the tenth rib in the posterior axillary line was noted. There was dullness on percussion posteriorly at the right base. Breath sounds were markedly diminished in this area. There was also slight tenderness on palpation in the right upper quadrant. Liver was enlarged about two finger-breadths below the right costal margin. Frequent stool examinations were negative. Proctoscopic examination revealed a friable mucosa and one pin-point ulcer. Specimen taken from scrapings failed to show any protozoal forms. White blood count was 24,750 with 80 percent neutrophils and 14.5 grams hemoglobin. Urinalysis was normal. Wassermann was negative. Agglutination tests for typhoid group and brucella were negative. All liver function tests were normal. X-ray of chest showed right diaphragm to be slightly elevated. Barium enema was negative.

It was felt that the patient had recurrent hepatic amebiasis. Patient responded very well to amebicide therapy. He was subsequently discharged with a normal blood count, sedimentation rate, and chest x-ray. The liver decreased in size and he was entirely asymptomatic.

SUMMARY

1. Latent amebiasis is a diagnostic dilemma which challenges clinician and surgeon, and will undoubtedly continue to do so, particularly in returned service personnel, and must be anticipated in all areas of the United States.

2. Early recognition is highly desirable as medical management may be successful, obviating aspiration or surgical drainage. Surgical aspiration still has its place in the presence of poor response to specific therapy or threatening spontaneous rupture.

3. One must not continue too long in hope of obtaining positive stool or proctoscopic verification as it is so often fruitless.

4. Penicillin therapy alone is of no value but should be considered a valuable adjunct to emetine when secondary invading organisms are suspected to be playing a role in hepatic amebiasis. Combined therapy postoperatively has already been emphasized elsewhere.

5. One large amebic abscess in the right lobe of the liver may respond to emetine and repeated aspirations as suggested by Bercovitz (14). Many times multiple lobe involvement is present, as pointed out by Craig. Early recognition is imperative for good results medically. Soiling following aspiration may occur and clinically one is unable to tell if secondary invading organisms are present, unless it is

proved by aspiration. It is generally believed 50 percent of amebic liver abscesses are secondarily infected when the diagnosis is made. When in doubt combined penicillin and emetine would appear wise.

6. Six successful medically treated cases of refutable hepatic amebiasis have been presented. During the course of this study, two unreported cases of liver abscess with typical anchovy sauce drainage were treated by successful surgical drainage. These latter two cases presented bulging of the lower right thoracic cage, exquisite tenderness, and were considered as cases of impending spontaneous rupture.

7. Careful follow-up studies are indicated in both medically and surgically treated hepatic amebiasis with roentgenograms of the chest, blood studies for continued leukocytosis and elevation of the sedimentation rate. Repeat courses of emetine are necessary as demonstrated in four of the cases treated entirely medically, and the one case of recurrence following surgical drainage elsewhere.

8. Case 5 demonstrates the problem of considering hepatic amebiasis as a precursor of amebic perinephric abscess. The anatomical proximity of the inferior surface of the right lobe of the liver and the right kidney easily explains this. Perirenal and renal spread, spontaneous rupture into the pelvis of the kidney has been described, but is very infrequent.

9. Early diagnosis, preferably before the stage in which pus could be demonstrated, should be the aim in hepatic amebiasis. This will lead to effective medical treatment with emetine and supplemental amebicides in contrast to more dangerous procedures when the disease carries a poorer prognosis. Promiscuous use of emetine should be avoided, but therapeutic trials are indicated in latent hepatic amebiasis because of the notoriously low percentages of positive stool identification.

10. Hospitalization for this method of treatment, careful laboratory, roentgen, and electrocardiographic studies are considered imperative to avoid disastrous results.

REFERENCES

1. GALLOWAY, B. T.: Extra-intestinal amebiasis and its diagnosis. *New Orleans M. & S. J.* 98: 373-384, Feb. 1946.
2. CRAIG, C. F.: *Etiology, Diagnosis and Treatment of Amebiasis.* The Williams & Wilkins Company, Baltimore, Md., 1944.
3. PAYNE, A. M. M.: Amebic dysentery in Eastern India. *Lancet* 1: 206-209, Feb. 17, 1945.
4. SODEMAN, W. A., and LEWIS, B. O.: Amebic hepatitis. *Am. J. Trop. Med.* 25: 35-39, Jan. 1945.
5. WALTERS, W.; WATKINS, C. H.; BUTT, H. R.; and MARSHALL, J. M.: Amebic abscess of liver, unsuspected until perforation. *J. A. M. A.* 125: 963-966, Aug. 5, 1944.

6. FAUST, E. C.: Prevalence of amebiasis in Western Hemisphere. *Am. J. Trop. Med.* 22: 93–105, Jan. 1942; *La importancia y predominio de la amebiasis en el hemisferio occidental*. *Semana méd.* 2: 961–973, Oct. 23, 1941.
7. OCHSNER, A., and DEBAKEY, M.: Amebic hepatitis and hepatic abscess: analysis of 181 cases with review of literature. *Surgery* 13: 460–493, Mar.; 612–649, Apr. 1943.
8. ELSOM, K. A.; ROGERS, A. M.; and WOOD, F. C.: Amebiasis; observation in Army general hospital in India. *Gastroenterology* 8: 135–153, Feb. 1947.
9. SNELL, A. M.: Clinical problems of amebiasis. *U. S. Nav. M. Bull.* 46: 1023–1040, July 1946.
10. MUNK, J.: X-ray appearances in amebic hepatitis. *Brit. J. Radiol.* 17: 48–53, Feb. 1944.
11. ROSS, J. A.: Amebic perinephric abscess. *Brit. J. Radiol.* 17: 289–290, Sept. 1944.
12. FERGUSON, L. K., and ANDERSON, R. K.: Amebic liver abscess in service personnel. *Gastroenterology* 8: 332–342, March 1947.
13. WARSHAWSKY, H.; NOLAN, D. E.; and ABRAMSON, W.: Hepatic complications of amebiasis. *New England J. Med.* 235: 678–681, 1946.
14. BERCOVITZ, Z. T.: Complications of amebiasis. *New York State J. Med.* 46: 2291, Oct. 1946.



ION TRANSFER OF PENICILLIN

Efficacy of Penicillin Iontophoresis in Treatment of Chancroidal Ulcers

ARMAND J. PEREYRA

Captain (MC) U. S. N.

THE treatment of localized infections in surface tissues of the body with penicillin by simple topical application has come into increasingly wider use during recent years. Such penicillin therapy has been advocated in diseases of the eye (1) (2), the ear and nasal sinuses (3), in mastoid infections (4), in diseases of the mouth (5), in pyodermas (6) (7) (8) (9) (10) (11) (12), in surface tissue wounds (13) (14) (15), in syphilitic ulcers (16), etc. The factors of simplicity, economy, and the very high local concentration attainable have importantly influenced the extensive use of penicillin in this manner.

The not infrequent failures encountered following this method of treatment, however, have brought into question the degree of absorption and the depth of penetration which may be reached when penicillin is employed by simple topical application in surface tissue infections. These failures would appear to indicate that when penicillin is used in this manner, tissue penetration is very superficial and absorption extremely limited. Experimental evidence to support this conclusion was elicited by Sophian (17). Such therapeutic failures and the implications as to their cause have led to the use of iontophoresis, or ion transfer, as a means of increasing the penetration and absorption of penicillin in surface tissue therapy. Successful use of ion transfer with penicillin has been reported by von Sallman and Meyer (18), by Dunnington and von Sallman (19), and by Abramowitch and Neoussikine (20). Recent reports in the literature, however, have cast considerable doubt on the feasibility of employing penicillin in iontophoresis. Hamilton-Paterson (21), has published experimental results purporting to show that penicillin salts are poor conductors or nonconductors of the electric current and, therefore, not suitable for use by ion transfer. Popkin (22), supports this view following his inability to demonstrate penicillin in the blood of humans treated with penicillin applied to the skin by iontophoresis. These conflicting

reports have left the subject of ion transfer of penicillin in a confused state. The experiments here presented were undertaken in an attempt to establish the scope and to clarify the issue of ionic transfer of penicillin.

IN VITRO EXPERIMENTS

Tests were conducted to determine the specific conductivity of stock sodium penicillin G and of crude sodium penicillin extract. The tests were made with aqueous solutions of these salts prepared in serially

TABLE 1.—*Results of electrical conductivity of penicillin*

[Specific conductivity of crude sodium penicillin extract. Weight of sample of lyophilized stock crude penicillin powder=918 units per milligram]

Penicillin (units per ml.)	Penicillin (mg. per ml.)	Specific resistance (ohms at 18° C.)	Specific conductance ($(L) \times 10^6$)
10,000	10.894	360	2,780
8,000	8.716	441	2,268
6,000	6.539	561	1,784
4,000	4.358	818	1,235
3,000	3.269	1,065	939
2,000	2.179	1,570	637
1,000	1.089	3,145	318
900	.968	3,435	291
800	.861	3,840	260
700	.753	4,350	230
600	.646	5,020	198
500	.538	6,030	166
400	.430	7,310	137
300	.323	9,760	102.5
200	.215	14,300	70.0
100	.108	28,300	35.3
50	.054	53,100	18.9
25	.027	96,000	10.4

NOTE.—Distilled water, specific resistance, 769000 ohms at 18° C.; specific conductance, $1.3 (L) \times 10^6$.

TABLE 2.—*Specific conductivity of pure sodium penicillin G*

[Weight of sample of crystalline sodium penicillin G=1,650 units per milligram]

Penicillin (units. per ml)	Penicillin (mg. per ml.)	Specific resis- tance (ohms at 18° C.)	Specific con- ductance ($(L) \times 10^6$)
10,000	6.058	1,066	938
8,000	4.846	1,345	743
6,000	3.635	1,770	565
4,000	2.424	2,520	397
3,000	1.818	3,345	299
2,000	1.212	4,920	203
1,000	.606	9,750	102.5
900	.545	10,650	93.8
800	.485	11,880	84.2
700	.424	13,450	74.4
600	.363	15,580	63.8
500	.303	18,490	54.1
400	.242	22,400	44.6
300	.181	29,100	34.4
200	.121	43,600	23.0
100	.060	80,500	12.4
50	.030	140,000	7.1
25	.015	222,000	4.5

NOTE.—Distilled water, specific resistance, 632,500 ohms at 18° C.; specific conductance, $1.6 (L) \times 10^6$.

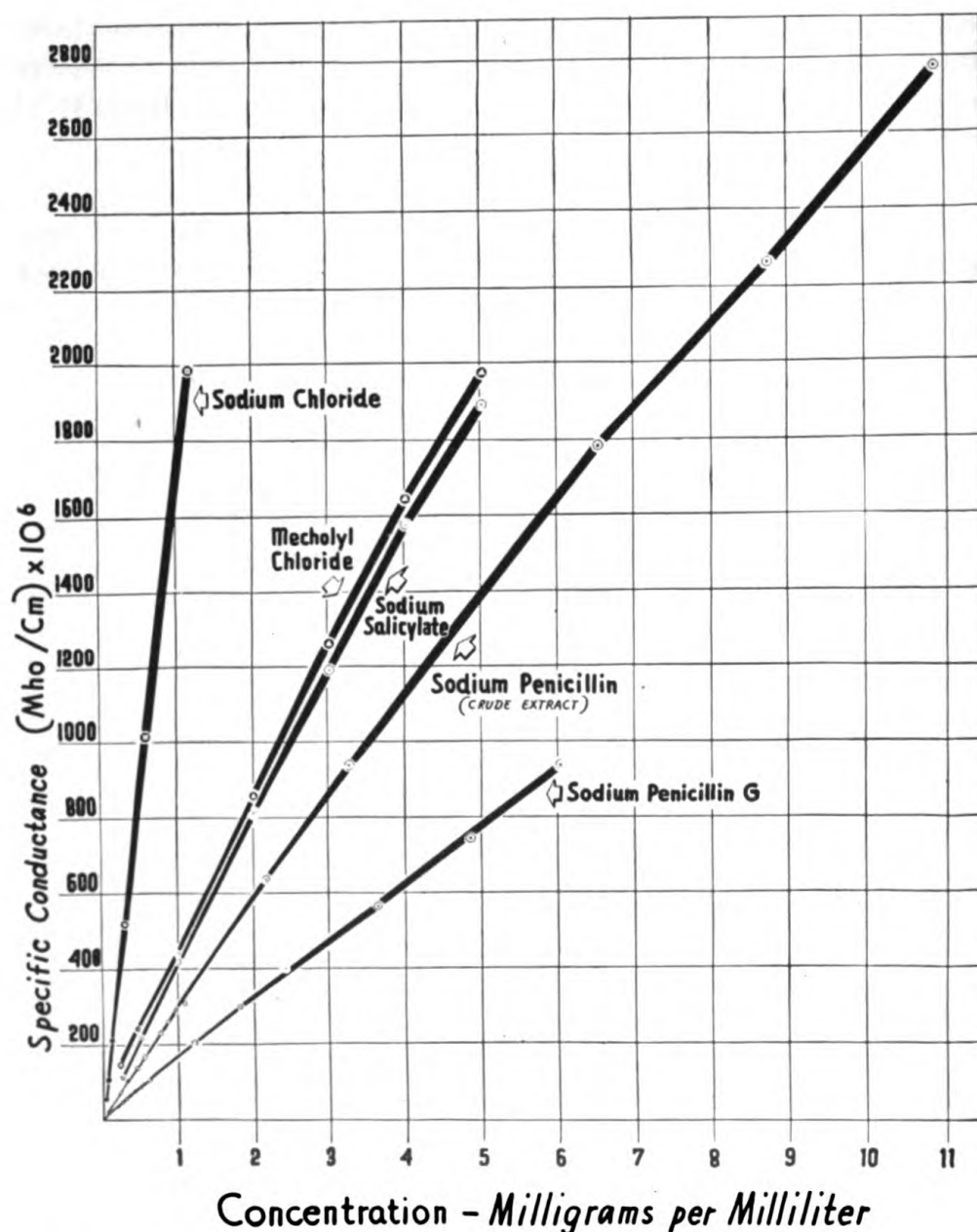


FIGURE 1.—Comparative specific conductivity curves of penicillin salts and other electrolytes used in iontophoresis based on their mass concentrations in aqueous solution.

increasing concentrations ranging in strength from 25 to 10,000 units of penicillin per milliliter. The mass of each salt was determined and conductivity curves were plotted on a graph to show the change in electric conduction with increase in strength of the solutions. A standard conductivity bridge employing dip type cells was used for the tests. For comparison, tests were carried out under the same conditions with a highly ionizing inorganic salt, sodium chloride, and

with two organic salts, mecholyl chloride and sodium salicylate, both commonly used in iontophoretic treatment. Conductivity curves for these salts were similarly plotted on the graph. The results of these tests are shown in figure 1, and tables 1 and 2.¹

IN VIVO EXPERIMENTS

Investigations to determine the absorption of penicillin by the intact skin with and without iontophoresis were carried out in four normal men using the volar anticubital skin of the forearm as the site of application. Six treatments were given to each subject on separate days under eight different test conditions involving variations in the size of the surface area, strength of solution, length of treatment, intensity of current, and method of application. Assays for penicillin in the blood and urine were made using a modification of the Rammelkamp method (23), with *Streptococcus hemolyticus* as the test organism. Stock crude sodium penicillin extract was used in these tests. (Penicillin content, 26.8 percent by weight—C. S. C.)

TECHNIC

Penicillin solution was applied to the skin in a glass chamber prepared from a 125 cc. Erlenmeyer flask. The base of this flask was cut off leaving an opening 6 cm. in diameter covering an area of 28.28 square centimeters. This open base was sealed to the skin with collodion applied to the rim. Eighty milliliters of penicillin solution were then poured into the glass chamber and the top closed with a stopper supporting a helical coil of copper wire which extended into the solution. This wire was connected to the negative terminal of a galvano-therapy unit. The positive terminal was connected to a thick layer of gauze wet with physiological salt solution and wrapped around one leg. (See fig. 2.).

The glass chamber was replaced by a 64-ply gauze pad covering the same surface area in tests to determine the effect upon absorption of this common method of application in iontophoresis.

The gauze was saturated with penicillin solution, a flat spiral copper wire was strapped firmly over the gauze pad and the whole bound to the arm. Additional solution was added during treatment to maintain saturation.

The same penicillin-saturated gauze was used to rub penicillin into the skin in experiments to determine absorption by embrocation. Application in this manner was made over the same skin area.

Comparative tests of absorption by inunction were also made with penicillin ointments rubbed into the skin. The ointments were pre-

¹ Determinations of electrical conductivity made with the assistance and collaboration of Messrs. Harold Robison and C. W. Wilson.



FIGURE 2.—Introducing penicillin into body through intact skin of arm by iontophoresis.

pared with tragacanth jelly base and with lanolin base. The ointments were rubbed into the same area of skin surface for 15 minutes.

Immediately before each treatment, the bladder was emptied by the subject and the urine stored in a sterile flask in the refrigerator. The bladder was again emptied into separate flasks at half-hour intervals up to 2 hours following treatment. On completion of the test, the urinary volumes were determined and assays made for penicillin content.

Blood was withdrawn from the opposite arm vein before treatment and at 15-, 30-, and 60-minute intervals following treatment. These blood samples were assayed for penicillin in a similar manner. All assays were carried out within 4 hours after completion of the tests.

RESULTS OF BLOOD ASSAYS FOR PENICILLIN

None of the bloods withdrawn either before or following treatment under the test conditions outlined in table 3 showed any penicillin present. In view of these findings, an additional experiment was carried out with iontophoresis using a glass chamber covering 88.54 square centimeters of skin. This was applied over the abdomen and filled with a solution containing 5,000 units of penicillin per milliliter. Treatment was given by iontophoresis with a 10 milliampere current for 30 minutes. In spite of the heavier concentration of solution, larger skin area treated, and higher intensity of current employed, penicillin could not be detected in the blood. The assay method used has a sensitivity of 0.009 units of penicillin per milliliter.

RESULTS OF URINE ASSAYS FOR PENICILLIN

None of the urines voided prior to treatment revealed any penicillin present. The urines collected following application of penicillin to the skin by embrocation or inunction likewise failed to show any penicillin present. Following treatment by iontophoresis, however, penicillin was found present in the urines. After applying penicillin to the abdomen under the conditions noted above, 810 units of penicillin were recovered in the urines in 2 hours. Preliminary studies with penicillin solution applied to the forearm by iontophoresis revealed that penicillin appeared in the urine within 15 minutes from the time treatment was begun and excretion was completed within 2 hours. These tests indicated that approximately 70 percent of the total penicillin recovered in the urine was excreted in the first 60 minutes following treatment. It was further determined that recovery of penicillin in the urine could be obtained by application of the negative electrode only to the solution in iontophoresis. The total urinary excretion of penicillin following treatment to the forearm under the test conditions employed is shown in table 3.

TABLE 3

Test No.	Area skin treated (sq. cm.)	Strength of penicillin (units per cc.)	Duration treatment (minutes)	Intensity of current (milliamps)	Method of application
1.....	28.28	1,000	15	5	Solution.
2.....	14.14	1,000	15	5	Do.
3.....	28.28	500	15	5	Do.
4.....	28.28	1,000	30	5	Do.
5.....	28.28	1,000	15	2.5	Do.
6.....	28.28	1,000	15	5	Gauze pad.
7.....	28.28	1,000	15	0	Embrocation.
8.....	28.28	1,000	15	0	Inunction.

UNITS OF PENICILLIN EXCRETED IN URINE (AVERAGE 6 TESTS)

Test No.	Subjects				Mean excretion
	A	B	C	D	
1.....	119	103	99	80	100.25
2.....	112	96	111	84	100.75
3.....	56	45	47	44	48
4.....	208	200	192	195	198.75
5.....	38	31	31	32	33
6.....	61	29	44	34	42
7.....	0	0	0	0	0
8.....	0	0	0	0	0

¹ Glass flask holding 40 cc. solution substituted.² Units per gram.

COMMENT

The conduction of the electric current by penicillin in aqueous solution is confirmed by the results of the in vitro tests reported in figure 1. The rate of current transfer has been shown to be a function of the mass concentration of the penicillin salts. The relative efficiency of penicillin as a conductor was established by comparative tests made with mecholyl chloride and sodium salicylate, two organic salts commonly employed in iontophoresis. These tests showed that at a concentration of 1 milligram per milliliter (1,650 units per cc.), sodium penicillin G conducted 38.8 percent the amount of current passed by a similar concentration of mecholyl chloride and 40 percent that conducted by sodium salicylate. With crude sodium penicillin extract, concentrations of 1 milligram per milliliter (918 units per cc.), showed 66.97 percent the conductivity of mecholyl chloride and 69.65 percent the conductivity of sodium salicylate. The relative conductivity of these four organic salts compared to conduction by the highly ionizing inorganic salt, sodium chloride, is illustrated by the curves in figure 1.

It is evident from these findings that penicillin salts are electrolytic, although to a lesser degree than the other organic salts tested. The inability of Hamilton-Paterson (21) to demonstrate conduction in his experiments may be explained by the low concentrations of penicillin employed. This author used solutions containing 25 and 50 units of

penicillin per milliliter but did not give the weight of penicillin salt involved. While these unit concentrations of penicillin are adequate from the standpoint of bactericidal activity, the results above set forth indicate clearly that it is the mass concentration of the salt present in solution which is the determinant of electrical conductivity. For the purpose of testing the iontophoretic possibilities of penicillin, therefore, the concentrations of penicillin employed by Hamilton-Paterson must be considered inadequate. In the tests reported here, 25 unit strengths of crude sodium penicillin extract gave only 0.027 milligrams of material per milliliter in solution. Such a solution yielded only a negligible transfer of current. The same strength of sodium penicillin G gave only 0.015 milligrams of material per milliliter in solution with still lower conduction (tables 1 and 2). When mecholyl chloride or sodium salicylate are employed therapeutically in iontophoresis, a concentration of 0.5 percent is usually necessary for satisfactory results. In view of the relatively lower conductivity of penicillin as brought out in the present studies, it is reasonable to assume that at least similar concentrations would be indicated in iontophoretic treatment with penicillin in order that equally substantial penetration and absorption be obtained. This minimal therapeutic level would require the use of crude sodium penicillin extract in concentrations of approximately 5,000 units per milliliter and of sodium penicillin G in concentrations of 8,000 units per milliliter in order to give 0.5 percent solutions. Such concentrations of penicillin are well tolerated by the skin and mucous membrane. It should be borne in mind, however, that lower concentrations (0.1 percent by weight), show measurable iontophoretic activity as brought out by the results tabulated in table 3.

It is of interest to note the effect of the manner of application of penicillin by iontophoresis upon the amount of absorption. Because of the ease of application, gauze or asbestos pads are commonly employed in this method of treatment. The use of such a pad in the present experiments decreased by over 58 percent the amount of penicillin introduced and recovered from the body in the urine (table 3). The conclusion is indicated that the use of the gauze pad, following the technique commonly employed, in some manner decreases the level of ion transfer as compared to the level obtained when using the solution in a glass chamber over the area being treated. The latter method permits a higher level of penicillin transfer to the tissue surface and would appear to be the method of choice wherever practicable.

It is evident from these tests that penicillin applied by embrocation or inunction does not absorb from the skin to any measurable degree. A driving force is needed to effect the movement of penicillin into the body in significant amounts. The electric current used in iontophore-

sis provides this driving force. However, the previously noted findings of Popkin (22) that bacteriostatic concentrations of penicillin in the blood are not obtainable by iontophoresis are confirmed by the present experiments. A plausible explanation is offered in the rapid dilution of the absorbed penicillin by the blood stream which precludes the possibility of obtaining bacteriostatic concentrations with the amounts transferred into the body by the current under the conditions of these experiments. Contrariwise, the action of the kidney in removing and concentrating the drug in the urine at measurable bacteriostatic levels has made possible the present determination of penicillin transfer by iontophoresis. The early appearance of penicillin in the urine observed following iontophoretic treatment to the skin indicates a rapid penetration of penicillin under the influence of the current to reach the deep vascular corium. It further suggests a rapid withdrawal of penicillin by the skin circulation so that the possibility of employing this method of treatment for the deeper subcutaneous tissues is questionable. The vascular corium acts as a barrier to further penetration of penicillin by its rapid absorption and withdrawal of penicillin from the skin.

The penicillin recovered in the urine in these experiments following iontophoresis undoubtedly represents only a part of the total penicillin introduced through the skin. According to Rammelkamp and Bradley (24), penicillin excretion in the urine averages about 50 percent of the amount injected into the body. It may be postulated that penicillin introduced by iontophoresis is likewise excreted only partially from the body. The unrecovered moiety added to the amounts obtained in the urine approximately doubles the values for penicillin determined as introduced into the body by iontophoresis. On this basis, a maximum of 14.24 units of penicillin were transferred through each square centimeter of skin in the tests conducted on the forearm (test No. 2, table 3). This represents a rate of transfer of slightly less than 1 unit of penicillin per square centimeter of skin per minute.

Objection has been made to the employment of iontophoresis with penicillin because of the alkalization produced in the solution by the current (Hamilton-Paterson). This shift in *pH* was confirmed in the present experiments, but its destructive action on penicillin was not verified when using the crude sodium penicillin extract. In the concentrations employed and with the volume of solution used, no appreciable destruction of penicillin resulted following application of penicillin by iontophoresis for 15 minutes with a 5-milliampere current. This is attributed in part to a buffering action of the inert salts present in the crude extract. The recovery of bacteriostatically active penicillin in the urine following iontophoresis further indicates that the destruction of penicillin through the alkalization produced by the

current is neither rapid nor complete. In order to limit alkalization of the solutions, however, distilled water only should be employed to dissolve penicillin intended for use by iontophoresis. Physiological salt solution should never be used as the solvent because of the more rapid alkalization produced by the current in such solution and also because of the interference with penicillin transfer through the presence of sodium chloride.

While the *in vivo* tests reported here were carried out with crude sodium penicillin extract, similar transfer of penicillin into the body and its recovery in the urine has been obtained following iontophoresis with crude calcium penicillin extract. No adverse effects on tissue have been observed incident to this method of treatment with penicillin applied repeatedly to the same skin area. Allergic reactions, however, may be produced with penicillin introduced into the body in this manner as well as are observed following parenteral injection in sensitive individuals. Inquiry should accordingly be made regarding previous reactions to penicillin before treatment is instituted.

Iontophoretic application of penicillin offers definite advantages over parenteral and simple topical administration in the treatment of localized surface tissue infections. The concentrations of penicillin obtainable at the site of application by iontophoresis exceed by far any values possible by the parenteral route. The use of iontophoresis assures greater penetration and local absorption by the tissues immediately involved in the lesion under treatment. The local therapeutic efficacy of penicillin is thereby much enhanced. This greater localized therapeutic potential of penicillin given by iontophoresis has been demonstrated in the treatment of chancroidal ulcers. Parenterally administered penicillin fails to effect healing of such ulcers, Pereyra and Landy (25), but when applied locally by iontophoresis, penicillin produces a prompt remission of these lesions. This finding has been substantiated by the author in a series of 13 cases of chancroidal ulcer successfully treated with penicillin by iontophoresis. In patients with chancroidal ulcer who are sensitive to sulfa drugs, this method of therapy has proved to be of particular value. The results here presented relative to the treatment of chancroidal ulcers are in accord with the findings of Mortara et al. (26), who reported the *in vitro* sensitivity of *Hemophilus ducreyi* only at comparatively high levels of penicillin concentration.

The results of the experiments above set forth are in satisfactory accord with the requirements of a salt suitable for use in iontophoresis. Penicillin is an anionic electrolyte which conducts the galvanic current readily in aqueous solution in the concentrations employed in these experiments. Its transfer into the body by iontophoresis is feasible in amounts which are directly proportional to the concen-

tration of penicillin salt used, the duration of treatment, and the strength of the current applied. The use of penicillin in this manner is justified, accordingly, in the therapeutic fields of application for which this method of treatment is indicated, within the limitations, and to the extent brought out in the experimental observations reported.

SUMMARY

1. Sodium and calcium penicillin in adequate concentration in aqueous solution are effective electrolytic salts.
2. Penicillin applied to the intact skin by iontophoresis is absorbed into the body and excreted in the urine in appreciable amounts.
3. Without iontophoresis, penicillin does not enter the skin in amounts sufficient to be detected in the urine.
4. Only the negative electrode of the galvanic current applied to solutions of these salts effects the transfer of penicillin into the body in iontophoresis.
5. Bacteriostatic levels of penicillin are not obtainable in the blood stream by the application of penicillin with iontophoresis on the skin.
6. The amount of penicillin recoverable in the urine following penicillin iontophoresis to the skin varies directly with the concentration of the solution, the duration of treatment, and the strength of the current employed.
7. The transfer of penicillin into the body in iontophoresis is accomplished most readily from free aqueous solutions of the salts, less readily from gauze pad applicators saturated with penicillin solution.
8. The introduction of penicillin into the skin by iontophoresis is obtained without detrimental effects on the tissue.
9. Penicillin applied by iontophoresis is effective in the treatment of chancroidal ulcers.

REFERENCES

1. CASHELL, G. T. W.: Treatment of ocular infections with penicillin. *Brit. M. J.* 1: 420-421, Mar. 25, 1944.
2. von SALLMAN, L.: Penetration of penicillin into eye; further studies. *Arch. Ophth.* 34: 195-201, Sept. 1945.
3. CROWE, S. J., FISHER, A. M., WARD, A. T., JR., and FOLEY, M. K.: Penicillin and tyrothricin in otolaryngology based on bacteriological and clinical study of 118 patients. *Ann. Otol., Rhin. & Laryng.* 52: 541-572, Sept. 1943.
4. FLOREY, M. E., and FLOREY, H. W.: General and local administration of penicillin. *Lancet* 1: 387-397, Mar. 27, 1943.
5. STROCK, A. E.: Relationship between gingivitis and penicillin administration; preliminary report. *J. Am. Dent. A.* 31: 1235-1236, Sept. 1, 1944.
6. TAYLOR, P. H., and HUGHES, K. E. A.: Infective dermatoses treated with penicillin. *Lancet* 2: 780-784, Dec. 16, 1944.
7. WAISMAN, M., and GOTS, J. S.: Penicillin in topical treatment of pyogenic infections of skin; clinical and laboratory observations. *Arch. Dermat. & Syph.* 53: 234-242, Mar. 1946.

8. TEMPLETON, H. J., CLIFTON, C. E., and SEEBERG, V. P.: Local application of penicillin for pyogenic dermatoses. *Arch. Dermat. & Syph.* 51: 205-208, Mar. 1945.
9. COHEN, T. M., and PFAFF, R. O.: Penicillin in dermatologic therapy; report or results in 100 cases. *Arch. Dermat. & Syph.* 51: 172-177, Mar. 1945.
10. GOTTSCHALK, H. R., ENGMAN, M. F., MOORE, M., and WEISS, R. S.: Penicillin ointment in treatment of some infections of skin. *Arch. Dermat. & Syph.* 53: 226-231, Mar. 1946.
11. HURIEZ, C., and LEBORGNE, J.: Quelques resultats de la pénicilline en dermatologie (avec 25 projections). *Ann. Dermat. Syph.* 5: 216, 1945.
12. MELLOTT, L. B., and PFUETZE, E. L.: Use of penicillin ointment in treatment of impetigo and other conditions of skin. *J. Kansas M. Soc.* 47: 7-8, Jan. 1946.
13. PULVERTAFT, R. J. V.: Local therapy of war wounds with penicillin. *Lancet* 2: 341-346, Sept. 18, 1943.
14. BODENHAM, D. C.: Infected burns and surface wounds; value of penicillin. *Lancet* 2: 725-728, Dec. 11, 1943.
15. FLOREY, H. W., and CAIRNS, H.: Penicillin in war wounds. *Lancet* 2: 742-745, Dec. 11, 1943.
16. ALSTON, J. M.: Use of crude penicillium filtrate for local treatment. *Brit. M. J.* 1: 654-656, May 13, 1944.
17. SOPHIAN, L. H.: Use of penicillin in topical application. *Am. J. M. Sc.* 208: 577-580, Nov. 1944.
18. von SALLMAN, L., and MEYER, K.: Penetration of penicillin into eye. *Arch. Ophth.* 31: 54-63, Jan. 1944.
19. DUNNINGTON, J. H., and von SALLMAN, L.: Penicillin therapy in ophthalmology. *Arch. Ophth.* 32: 353-361, Nov. 1944.
20. ABRAMOWITCH, D., and NEOUSSIKINE, B.: Treatment by Ion Transfer (Iontophoresis). Grune and Stratton, Inc., New York, N. Y., 1946.
21. HAMILTON-PATERSON, J. L.: "Ionization" of penicillin. *Brit. M. J.* 1: 680-682, May 4, 1946.
22. POPKIN, R. J.: Penicillin by iontophoresis. *J. A. M. A.* 132: 238, Sept. 28, 1946.
23. RAMMELKAMP, C. H.: Method for determining concentration of penicillin in body fluids and exudates. *Proc. Soc. Exper. Biol. & Med.* 51: 95-97, Oct. 1942.
24. RAMMELKAMP, C. H., and BRADLEY, S. E.: Excretion of penicillin in man. *Proc. Soc. Exper. Biol. & Med.* 53: 30-32, May 1943.
25. PEREYRA, A. J., and LANDY, S.: Experimental prophylaxis and treatment of chancroidal infection; inefficacy of penicillin administered intramuscularly. *U. S. Nav. M. Bull.* 43: 189, July 1944.
26. MORTARA, F., FEINER, R. R., and LEVENKRON, E.: Activity of penicillin against *Hemophilus ducreyi* in vitro. *Proc. Soc. Exper. Biol. & Med.* 56: 163-166, June 1944.



DECORTICATION OF LUNG IN ORGANIZING HEMOTHORAX AND EMPYEMA

EDWARD S. LOWE
Captain (MC) U. S. N.

DECORTICATION of the lung, although not a new procedure, proved its worth in rehabilitating thoracic casualties during World War II, and has gained popular acceptance. It is a satisfactory and satisfying procedure when employed where indicated in that one can see dramatically the pathology, and equally dramatically its rectification by operation. When the thorax is opened, one can see the lung splinted in a position of greater or lesser collapse by a dense fibrinous nonyielding membrane, and when this membrane is peeled off the lung, one can see the lung reexpand to fill completely the thoracic cavity. One sees a "lung cripple" rehabilitated.

This operation is by no means limited to wartime surgery, but is equally applicable to peacetime or civilian surgery. In the war there was a great incidence of chest injury, and these injuries tended to be more severe than civil injuries because of the nature of the causative agent; hence our attention was focused upon these injuries and the means of treatment at our disposal. Decortication may be employed in the treatment of fibrinous pleurisy secondary to hemothorax and in fibrinous pleurisy secondary to acute or chronic empyema.

Fluid in the pleural space calls for early adequate and repeated aspiration as needed to reexpand the lung. The presence of blood predisposes to infection, mechanically it acts to collapse the lung, and in many instances the blood becomes organized forming a fibrinous constricting membrane which holds the lung in a state of atelectasis until it is removed surgically by decortication. Similarly an infected exudate (suppurative pleurisy, empyema) acts mechanically to collapse the lung, and the fibrinous exudate which is thrown down holds the lung from expanding when it becomes organized to sufficient thickness and density. Air should not be injected following aspirations as it further hampers expansion of the lung. Aspiration should be continued in those patients showing either fluid or air in the pleural space. The prognosis for expansion of the lung and closure of the pleural space depends upon finding evidence of lung expansion and decrease in fluid by physical examination and by x-ray following aspi-

ration. Drawing off decreasing amounts of fluid in succeeding aspirations indicates a favorable prognosis except that in some cases of hemothorax organization of the clot may prevent aspiration of fluid. Continued refilling of the pleural space in hemothorax despite repeated aspirations indicates that organization is taking place continuously; hence the chances for reexpansion of the collapsed lung are not good and decortication is indicated.

Thoracotomy is indicated early in the treatment of cases of hemothorax in which the lung is compressed and in which coagulation of the blood has taken place precluding removal of blood by aspiration. Similarly thoracotomy is indicated early in those cases of empyema in which the pus cannot be aspirated. In hemothorax if the lung is fairly well expanded and there is only a small amount of fluid, absorption can be expected if infection does not occur. Thoracotomy plus decortication is indicated in those cases of hemothorax having fibrinous pleurisy and atelectasis. The same procedure is indicated in multilocular empyema and in total empyema with collapse of the upper lobe, whether it be due to posttraumatic infection, postpneumonic infection, or result from infection of a clotted hemothorax.

The ideal time for decortication in hemothorax is thought to be approximately from 3 to 4 weeks after injury because by that time one may be assured that the lung is not to be expanded by other more conservative means, the fibrinous membrane is not too densely adherent to the lung, and permanent fibrosis has not taken place in the lung. Decortication, however, has been done as early as 6 days after injury in the cases where the need of this procedure was apparent and nothing was to be gained by delaying. In cases taken to surgery early, the imprisoning fibrin layer is found to be thin and to peel away with ease, with minimal bleeding, and leaving a smooth glistening visceral lung surface. The lung expands readily. After the optimal time, decortication becomes progressively more difficult technically. The fibrin layer thickens and becomes more adherent to the lung so that the line of cleavage is more difficult to establish and to develop. More bleeding is encountered and the likelihood of breaking into the lung with soiling is greater. Reexpansion of the lung is progressively more difficult to accomplish in cases of long duration because of development of interstitial fibrosis so that in old cases it may be impossible of accomplishment. Decortication should be done in empyema as soon as it is apparent that the atelectatic lung will not expand under open or closed drainage. The earlier the decortication, the easier the peel will separate and the earlier the infected space will be eliminated by the expanded lung.

The technic we employed in decortication of the lung is as follows: The patient is administered a general anesthetic and the intra-

tracheal tube introduced following which he is placed on the table with the part of the thorax to be opened presenting, and a whole blood transfusion started. The site of the incision for the thoracotomy is determined by the location of the pathology in the chest, the incision being placed to give the best access to the compressed lung. In complete collapse and in collapse of the upper lobes, it is important to place the thoracotomy incision sufficiently high to enable the surgeon to reach the apex of the pleura, and is best placed posterolaterally over the fifth, sixth, or seventh rib. The rib is exposed subperiosteally and sufficient of it (at least 12 to 15 cm.) is resected to allow for the introduction of the operator's hand into the thorax. The parietal pleura is incised and the clots, fluid blood, and blood fibrin are removed by hand, suction, and wiping. Loculi are broken down and fibrinous bands are cut away. When the cavity is clean and dry, the fibrinous membrane-like envelope which encases the lung is carefully incised down to the lung. This step can be facilitated by having the anesthesiologist increase the intrapulmonary pressure causing the lung to bulge through the incision as it is made, thus indicating the line of cleavage. As soon as the line of cleavage is determined, the encasing fibrinous membrane is freed from the lung by means of wiping with gauze, sweeping with the fingers, and sharp dissection as required, carrying the dissection to where the covering leaves the lung to become parietal. Here it is excised and removed, completely extirpating the portion which has encased the lung. If a similar membrane is present in the interlobar fissures it is removed. The parietal portion of fibrinous membrane is not removed, as doing so only adds to the operative time and bleeding without contributing anything worth while to the procedure. In cases where there is not complete collapse of the lung and there are adhesions between the visceral pleura of the non-collapsed portion of the lung and the adjacent parietal pleura, the writer feels that these adhesions should be separated so that the pleural space may be obliterated by the expansion of the entire lung and not by expansion of the decortication portion only.

In the course of decortication it is extremely important for the operator to avoid entering the pericardium and on the right not to tear into the thin-walled azygos vein. Care must be taken to avoid tears into the parenchyma of the lung. Major tears should be sutured with mattress sutures, as should old broncho-pleural fistulae if they are inadvertently encountered.

When the lung is completely decorticated and hemostasis established, employing fibrin foam if necessary, two catheters are introduced into the pleural space by means of trocars, one in the second or third interspace anteriorly, and the second in the posterior axillary line inferiorly. The latter is a drain to carry off blood, serum, and exudate. The an-

terior catheter is employed to evacuate air trapped in the pleural space. Both act to maintain expansion of the lung. The incision is closed in layers around a catheter, and this catheter is removed by the surgeon when the closure is sufficiently airtight and upon inflation of the lung by the anesthetist.

The anterior catheter is connected to a negative pressure apparatus as a Wangenstein system, and the posterior drain is run over the side of the bed under a water seal. One must be sure that the pull on the anterior catheter is not sufficient to overcome the pull of the posterior drainage system and bring water and drainage from the drain bottle up into the pleural cavity. In infected cases, penicillin may be left in the pleural space upon closing, in which case the posterior catheter is clamped off for 12 hours before opening. Irrigation through these catheters is recommended against strongly because of danger of introducing infection. The catheters are removed at the earliest possible time to avoid infection. The posterior tube will function for 24 to 48 hours before becoming plugged with blood or the lung becomes adherent and seals it off. Cessation of oscillations of the water in the tube with respiration indicates the termination of its usefulness at which time it should be removed. The anterior drain may be tested similarly.

Needle aspiration is performed as required after removal of the drains. Rehabilitation of the patient is furthered by employing blow bottles, and by teaching him to develop and use the accessory muscles of respiration.

CASE REPORTS

Case 1—Chronic fibrinous pleuritis with atelectasis following hemothorax of unknown etiology.—E. V. A., StM3/c, USN, a 19-year-old Filipino male, was admitted to the U. S. Naval Hospital, Alca Heights, T. H., on 2 February 1946 with the diagnosis of DU (pneumonia) and complaining of pain in the left chest of 6-hour duration and of malaise and fever. He stated he was well until the morning of admission other than being conscious for the past 2 months of a dull chest pain when he was tired, and of dyspnea on exertion for that length of time. The chest pain was present when he awoke on the day of admission and was aggravated when the patient attempted to work. He had no cough, no "cold," no chills, or no chest injury in the immediate past, nor any chest pain similar to the present attack. His past history disclosed the following pertinent facts: Three years previously while attempting to escape from the Japanese, he received a severe blow to the left chest. The chest was sore for a few days and then apparently bothered him no further. Four months ago, he was struck on the left chest while engaged in a fist fight, but he states he was not hurt.

Physical examination revealed the presence of fluid completely filling the left pleural space and the mediastinum shifted to the right, a distance of 5 cm. as determined by percussing the right heart border. X-ray showed the left chest to be entirely obscured by a dense fluid shadow and the mediastinum shifted, as indicated in the physical examination. A diagnostic thoracentesis was done withdrawing 6 cc. of chocolate-colored fluid. On the sixth hospital day 1,260 cc. of

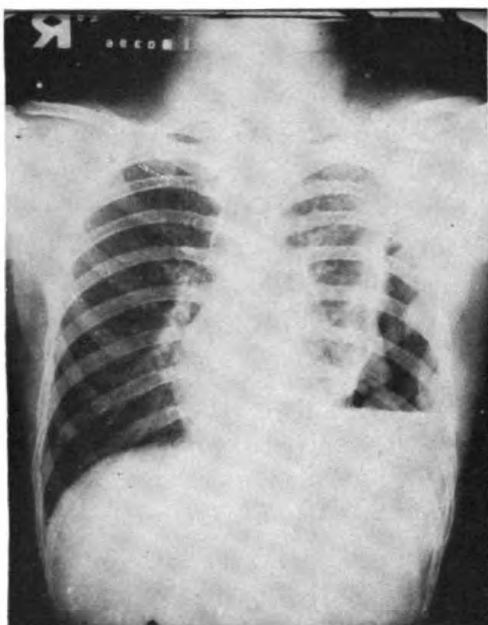


FIGURE 1.—Case 1. Preoperative x-ray following aspiration of fluid from left thorax showing atelectasis, thickened pleura, fluid level, and mediastinal shift.

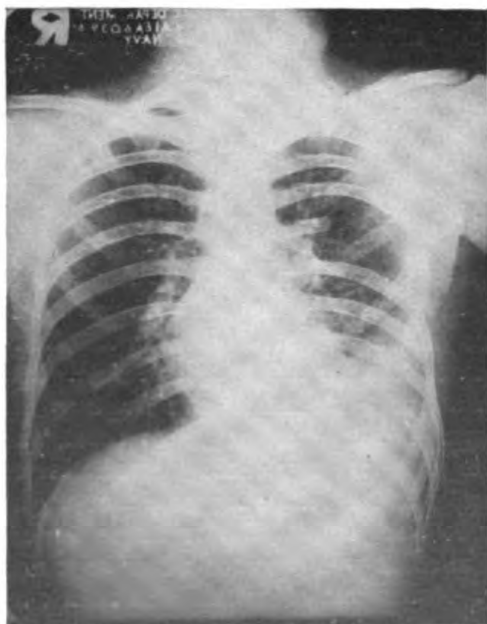


FIGURE 3.—Case 1. Postoperative x-ray showing lung reexpanded to completely fill the left thoracic space following decortication. Fluid and thickened pleura are evident in the left base.

similar fluid was withdrawn, and x-ray study made which revealed a left hydropneumothorax with the process loculated in the lower two-thirds of the left thoracic cage and almost complete collapse of the left lower lobe. Laboratory study of the fluid showed it to be negative for malignant cells, ova, parasites, and micro-organisms, including tuberculosis. In the next 3 months, the pleural space was repeatedly aspirated, a total of 5,310 cc. of fluid being removed. On different occasions the pleura was rendered al-



FIGURE 2.—Case 1. Preoperative x-ray following further aspiration showing continued atelectasis, thickened pleura, and inability of lung to expand to fill the pleural space. An oval mass of increased density is present in the inferior portion of the left pleural space which at operation proved to be a mass of fibrin.

most completely dry. X-rays on these occasions revealed the presence of an oval mass of increased density in the left pleural base 5 by 7.5 cc. which was variously interpreted as being fibrin, clotted blood, and a tumor. The lung was never completely re-expanded, and the pleura was seen to

be greatly thickened. Fluid reformed following each tap. That the pleural space and contents did not become infected, forming an empyema, is subject for wonder and speaks highly for the aseptic technic employed. On 13 May 1946 a left thoracotomy with decortication was done according to the technic described above. Approximately 200 square centimeters of a dense, tough, fibrinous sheet 1 to 2 millimeters thick was extirpated from the lung, and an amorphous mass of fibrin weighing 160 grams was removed from the pleural space. At the completion of the decortication, the lung could be expanded to fill the thoracic space. Catheter drains were placed and the chest wall was closed. The patient had a stormy postoperative course running a tachycardia of 110 to 120 and temperature up to 102° F. for about 4 weeks despite prophylactic treatment with penicillin and sulfadiazine. X-ray demonstrated small accumulations of fluid in the pleural space which were aspirated on several occasions without influencing the temperature curve. After about 28 days the patient's fever subsided, he began to feel well, to get about, and to eat better. On discharge to duty 2 months post-operatively temperature, pulse and respiration were normal, the patient had no complaints, and had gained 13 pounds in weight. X-ray showed the left lung to be completely reexpanded and the mediastinum in its normal position. A diffuse increased density persisted in the left base, due to thickened parietal pleura which was not removed at operation.

Case 2.—Massive organized hemothorax following stab wound of the chest.—W. E. A., Pfc., USMC, a 19-year-old white American male, was admitted by transfer to the U. S. Naval Hospital, Aiea Heights, T. H., on 4 April 1947 complaining of pain in the left chest and dyspnea on exertion and giving a history of having been stabbed in the left chest during a brawl 2 weeks previously. He stated that blood had been aspirated in large amounts from his chest on two occasions since injury and that he had received one blood transfusion. Physical

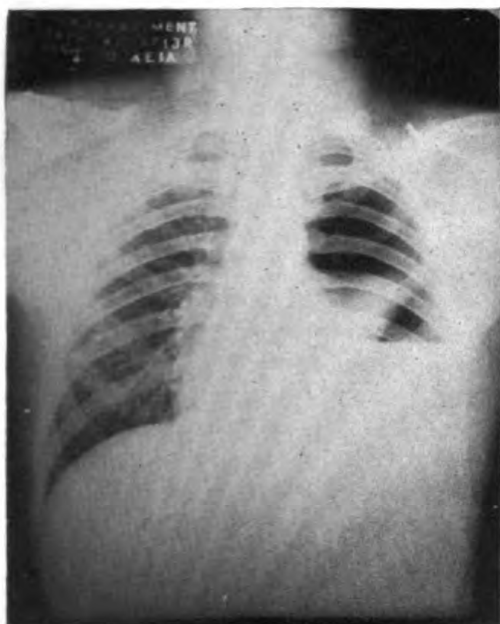


FIGURE 4.—Case 2. Preoperative x-ray following paracentesis of the left chest showing complete atelectasis of the exposed portion of the lung, fluid, and pneumothorax.

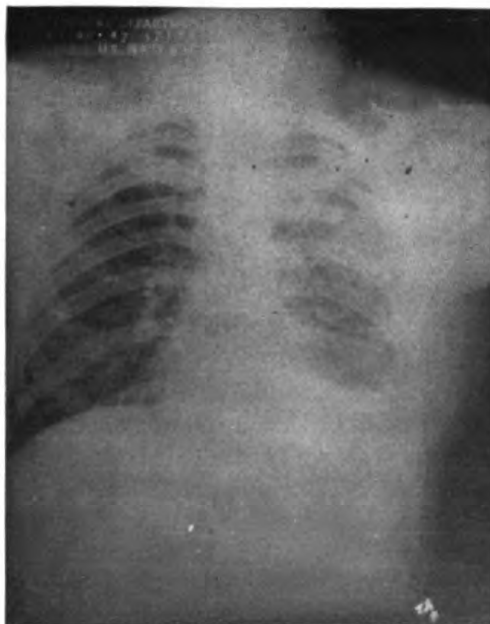


FIGURE 5.—Case 2. Postoperative x-ray showing complete reexpansion of the left lung following decortication. A small amount of fluid is present which absorbed without aspiration.

examination showed a scoliosis to the left, a recently healed stab wound in the left lower chest posteriorly, and indicated the left pleural space to be filled completely with fluid and the right lung hyperresonant. X-ray examination showed the left chest to be completely obscured by fluid and the mediastinum shifted to the right. Thoracentesis was done, removing 1,700 cc. of bloody fluid from the left chest without embarrassment. X-ray following this (9 April 1947) showed a fluid level at the eighth rib posteriorly on the left, with a pneumothorax above and complete collapse of the left lung. The mediastinum indicated less shift to the right. On 11 April 1947 thoracotomy was performed, removing 20 cm. of the left sixth rib posterolaterally; 700 cc. of blood, clots, and fibrin were removed, revealing the left lung completely collapsed. Decortication was done easily by removing a thin friable peel off the lung to its hylus and from the interlobar septum. Catheter drains were placed anteriorly and posteriorly and the lung expanded to fill the thoracic space. The incision was closed in layers, negative pressure was applied to the anterior catheter, and the posterior drain was led over the side of the bed beneath a water seal. The anterior catheter was removed in 48 hours and the posterior in 3 days. The patient made an uneventful recovery. X-ray made postoperatively showed the left lung to be completely reexpanded, but with some haziness from the thickened partial pleura which was not removed surgically.

Case 3.—Tuberculous loculated suppurative pleuritis with atelectasis.—W. T. K., GM3/c, USN, a white American male, 23 years of age, was transferred to the U. S. Naval Hospital, Alea Heights, T. H., on 3 October 1946 with a diagnosis of pleuritis serofibrinous and complaining of marked shortness of breath, particularly on exertion. He gave a history of malaise, weakness, nausea, vomiting, and anterior right-chest pain starting approximately 6 weeks previously. One month prior to admission, while at work, the patient experienced a sudden sharp severe constricting pain in the right chest and he fainted. He was hospitalized immediately, with a diagnosis of pneumonia, and treated with penicillin. Three days later 1,800 cc. of fluid were removed from the right pleural cavity and 4 days later 420 cc. were removed. At this time, the patient began to expectorate about a cupful of sputum a day. This sputum was negative for acid-fast bacilli on several examinations but was positive for pneumococcus type 18. The pleural exudate was also negative for acid-fast bacilli and was negative on culture. The patient was febrile, running a temperature elevation to 104° F. had had no chills nor no night sweats, but had lost approximately 60 pounds in weight. There was no family history of tuberculosis. On admission here physical examination revealed respiratory lag in the right chest and evidence of fluid. X-ray examination showed the right lung to be collapsed medially with fluid in the right lateral base and air above. It was noted on anteroposterior and lateral chest projections that there were several fluid-levels present, indicating loculation. Thoracentesis on several occasions was done, withdrawing viscous straw-colored fluid which, in each case, failed to reveal the presence of tumor cells or acid-fast bacilli and which was negative on smear and ordinary cultural methods.

Because of our inability to reexpand the lung by aspiration and because of the patient's illness and disturbed respiratory physiology and our belief that the effusion was secondary to pneumonia, a decortication of the right lung through resection of 20 cm. of the right sixth rib posterolaterally was done on 24 October 1946. Upon entering the thorax through the rib bed, numerous connecting loculations containing about 800 cc. of fluid and an unestimated amount of air were encountered. These were broken into and the fluid aspirated revealing a dense fibrinous septum running from the apex of the pleural space to the diaphragm in the sagittal plane compressing the lung to approximately one-third of its normal

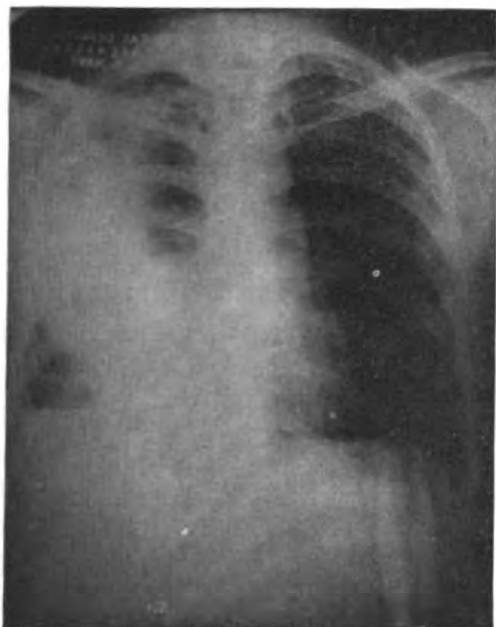


FIGURE 6.—Case 3. Preoperative anteroposterior x-ray showing atelectasis, pleural thickening, hydropneumothorax and multiple fluid levels on the right.



FIGURE 7.—Case 3. Preoperative right lateral x-ray showing in the lateral projection the same findings as in the anteroposterior.

volume. This fibrinous septum was peeled from the lung and extirpated at the visceral-parietal junction. Upon completion of the decortication, it was determined that the lung could be expanded to completely fill the pleural space, catheter drains were placed, and the incision closed. The catheters were removed after several days, some reaccumulation of fluid requiring aspiration was had, fairly good expansion of the lung obtained, and the incision healed by primary intention. Pathological examination of the fibrinous membrane which was up to 5 mm. in thickness in some places and which grossly showed nodular projections 2 mm. high on the inner surface revealed microscopically the presence of tubercles, giant cells, and acid-fast bacilli. The diagnosis of tuberculosis (suppurative pleuritis) was established. Postoperatively the patient improved greatly, gained 20 pounds in weight, was relieved of dyspnea, and ran a maximum daily temperature of 99° F. He was evacuated to the mainland on 19 December 1946 for further treatment and disposition.

DISCUSSION

In each of these illustrative cases the lung could not possibly have been reexpanded without the extirpation of the constricting membrane; hence without surgery, respiratory physiology would have remained impaired permanently and the patients would have been chronic lung cripples. Case 2 was decorticated at the most favorable time, as shown by the technical ease of the procedure, the ease with which the lung reexpanded and stayed, and the short easy postoperative course. Had this case been aspirated adequately and re-

peatedly immediately following his injury, it is likely that decortication would not have been required, as he suffered minimal intrathoracic trauma and very few blood clots were present. The duration of the hemothorax in case 1 is impossible of determination; however, we are convinced that it was of long duration, probably dating back to the trauma suffered 3 years previously. The peel in this case was very thick and adherent, hence difficult to remove, and the lung must have been considerably fibrosed as indicated by the difficulty in holding it out postoperatively. This patient's convalescence was more prolonged and difficult than that of the case of shorter duration.

Case 3 was decorticated under a diagnosis which was only partially correct. Pathological examination of the material removed enabled us to establish the etiological diagnosis. The procedure helped the patient greatly and was accomplished without untoward incident. Decortication was warranted and justified in this case of tuberculous pleurisy with organizing exudate, atelectasis, and hydropneumothorax.

CONCLUSIONS

Decortication of the lung is a satisfactory and satisfying operation in cases of fibrinous pleurisy with atelectasis secondary to hemothorax or infection. Through this procedure a limiting membrane is peeled off a constricted lung and extirpated, enabling the lung to reexpand to fill the thoracic cavity, close an abnormal space, and resume normal physiological functions. We know of no way to remove this membrane other than mechanically at operation.

BIBLIOGRAPHY

1. JONAS, A. F.: Massive organizing hemothorax. *Surgery* 20: 168-173, Aug. 1946.
2. MARTIN, J. D., Jr.: War wounds of chest. *Surgery* 21: 381-389, Mar. 1947.
3. SANGER, P. W.: Decortication in acute empyema thoracis. *Surg., Gynec. & Obst.* 82: 71-80, Jan. 1946.
4. TUTTLE, W. M.; LANGSTON, H. T.; and CROWLEY, R. T.: Treatment of intrathoracic wounds. *Surg., Gynec. & Obst.* 81: 158-168, Aug. 1945.



THERAPY OF THROAT INFECTIONS WITH BISMUTH vs. PENICILLIN

BORIS SCHUSTER¹

Commander (MC) U. S. N.

AN ACUTE throat infection is usually considered a self-limited disease lasting from 7 to 10 days unless complications such as peritonsillar abscess, otis media, or nephritis occur. The usual symptom complex consists of fever, general malaise, dysphagia, and glandular swelling. The physical findings vary, but generally consist of acutely inflamed tonsils and/or acutely inflamed hypertrophied follicles in the pharynx. Bacteriological findings vary from mixed infections with spirilliform bacteria to pure cultures of beta hemolytic streptococci.

In most cases the patient has to be confined to sick bay for the duration of the illness, not only for therapy, but to prevent spread of infection to ship's company.

The 1942 calendar year report for the U. S. Navy (1) on acute throat infections revealed a ratio of 35.67 per 1,000 with 187,589 sick days for the year.

TONSILLITIS, ACUTE

There were 18,564 primary and 11 secondary cases of acute tonsillitis during 1942, making the combined attack rate 22.26 per 1,000 as compared with 20.50 in 1941 and a 9-year rate of 20.94.

Acute tonsillitis was responsible for 110,902 sick days for all cases treated. An average of 36 men per 1,000 was constantly on the sick list as compared with 41, the median noneffective ratio for the preceding 9 years.

PHARYNGITIS, ACUTE

There were 6,349 original admissions for this disease during the year 1942, making the admission rate 7.61 per 1,000 as compared with 3.52 in 1941, and 3.10, the median rate for the preceding 9 years.

There were 34,377 sick days recorded for acute pharyngitis, or a daily average of 11 men per 100,000 constantly on the sick list. The median noneffective ratio for the preceding 9 years is 5.

¹ Resigned 12 October 1946.

ANGINA, VINCENT'S

Angina, Vincent's was responsible for 3,049 new admissions, or an admission rate of 3.65 per 1,000 as compared with 3.33 per 1,000 in 1941, 3.92 per 1,000 in 1940, and 3.92 the median rate for the preceding 9 years.

There were 29,660 sick days for all cases treated during 1942, or a daily noneffective ratio of 10 per 100,000. The median rate for the preceding 9 years is 11 per 100,000.

LARYNGITIS, ACUTE

In 1942 there were 1,377 new admissions for acute laryngitis, making the admission rate 165 per 100,000 as compared with 85 per 100,000 in 1941, and 83, the median rate for the preceding 9 years.

There were 8,656 sick days recorded for this disease, or a daily average of 3 men per 100,000 constantly on the sick list. The median noneffective ratio for the preceding 9 years is 2.

SEPTIC SORE THROAT

There were 523 new admissions for septic sore throat in 1942, making the admission rate 63 per 100,000 as compared with 52 per 100,000 in 1941, and 10, the median rate for 1933-41.

A total of 3,994 sick days was recorded for this disease, or an average of 1 man per 100,000 constantly on the sick list. The median noneffective ratio for the preceding 9 years is 0.41 per 100,000 (1).

A 16-week average during 1945 (12) gave a ratio of 56.44 admissions per 1,000 of tonsillitis and pharyngitis, acute.

Symptomatic treatment with salicylates, coedine, gargles, and sulfonamides have proved disappointing (2) (3) as far as decreasing the symptoms and reducing the number of sick days. Penicillin therapy has proved more efficacious in our hands with symptoms subsiding within 24 to 48 hours in most cases.

Monteiro (4) in 1934 published a very interesting clinical report on efficacy of bismuth compounds in treatment of nonspecific infections of the throat. In 1939 Pescetti (6) demonstrated experimentally that bismuth could be demonstrated in tonsil tissue within 8 hours after intramuscular injection. Further clinical data by Monteiro (5) was published in 1941 and Lewis (7) 1942. In 1943 Silber (8) published an excellent article with extensive bibliography on the use of bismuth in treatment of acute throat infection in children in form of soluble bismuth suppositories. In 1944 Silber (9) reported detailed clinical study on the low toxicity of bismuth in therapeutic doses. Stovin (10) added further clinical data in 1944 with case reports. He further reported (11) the efficacy of bismuth preparation for pretonsillectomy and postoperative reduction of morbidity from pain and inflammation.

In 1944, following the report of efficacy of bismuth salts in acute throat infections (9) and before penicillin was available for the general public, bismuth subsalicylate administration was begun in treatment of acute throat infections in the out-patient department of the Thirteenth Naval District. The doses varied from 0.13 grams bismuth subsalicylate (1 cc. bismuth subsalicylate in peanut oil) in infants and children up to about 12 years of age, to 0.26 grams in children over 12 and in adults. No other form of therapy was used in over 70 patients ranging in age from 6 weeks to 63 years. In approximately one-third of the cases it was necessary to repeat the dosage in 24 hours. The symptomatic relief was spectacular, with older children and adults reporting subsidence of pain and dysphagia within 6 to 8 hours. Infants would resume eating within 6 hours of the administration of the medication.

In contrast to the symptomatic relief, physical examination failed to show any marked change in the appearance of the involved tonsils or pharynx. Those who had elevated temperatures prior to administration of medication, failed to show any marked reduction of temperature even though the symptoms had subsided within 6 to 24 hours. In nearly all cases the temperature and physical findings were found to be within normal limits on the third or fourth post-therapeutic day.

With penicillin available in sufficient quantities so that all acute throat cases could be treated at the U. S. Naval Dispensary, with it a series of cases were studied to evaluate the relative value of bismuth and penicillin therapy so far as morbidity and hospitalization were concerned.

Penicillin was administered in either 30,000 units every 30 hours until symptoms subsided, or given in 100,000 units in 2-percent beeswax in peanut oil every 24 hours until symptoms subsided. About half of the patients received sulfadiazine in conjunction with penicillin.

There was no question of the superiority of penicillin in treatment of Vincent's organism infections of the throat. Our cases were discharged symptom-free and smear-negative within 24 to 48 hours after penicillin therapy. Bismuth was not used in these cases since response to penicillin was satisfactory.

There were 42 cases of acute tonsillitis treated and 26 cases of acute pharyngitis. The average hospitalization for acute tonsillitis was 4.1 days; for acute pharyngitis 3.9 days. There were 12 cases of acute tonsillitis treated with bismuth subsalicylate alone. They averaged 3.5 days hospitalization. Thirty were treated with penicillin alone or/and with sulfadiazine with an average of 3.7 hospital days. Ten acute pharyngitis cases were treated with bismuth subsalicylate alone and averaged 3.2 hospital days. Sixteen cases treated with penicillin alone averaged 4.4 hospital days. The remainder of the cases received

combined penicillin, bismuth, and sulfadiazine, and are not considered in this series for evaluation.

DISCUSSION

Except in the treatment of acute follicular pharyngitis, there seems to be little choice between bismuth and penicillin. In cases of follicular tonsillitis, the symptomatic relief is much more rapid (6 to 8 hours) than where penicillin is used (24 to 36 hours). Hospitalization is 1 day less when bismuth salts are used.

It is realized that on the basis of such a small number of cases, conclusions are apt to be erroneous, however, clinical trial is more convincing than an article, and if this brief report stimulates further study it will have accomplished its purpose.

The major disadvantage of bismuth as well as penicillin in therapy of acute throat infections is the fact that the medications have to be administered parenterally with no little discomfort to the patient. A new soluble bismuth suppository (8) (9) (10) is available commercially which is nonirritating and is as efficacious as the parenterally administered bismuth. We have used the suppositories with good result.

CONCLUSION

Bismuth salts are efficacious in treatment of acute throat infections, but except in acute follicular pharyngitis have no advantage over penicillin therapy.

REFERENCES

1. Medical Statistics, Report of the Surgeon General. United States Navy, Calendar Year 1942.
2. RHOADS, P. S., and AFREMOW, M. L.: Sulfanilamide in treatment of sore throat due to hemolytic streptococci with controls. *J. A. M. A.* 114: 942-943, Mar. 16, 1940.
3. Personal communication with medical officers, U. S. Naval Training Station, Farragut, Idaho, 1944.
4. MONTEIRO, A.: Une nouvelle thérapeutique le bismuth dans le traitement des angines aiguës non spécifiques. *Ann. d'otolaryng.* 7: 557-566, June 1934.
5. Monteiro, A.: Modern treatment of acute tonsillitis by injection of bismuth compounds. *Arch. Otolaryng.* 34: 719-722, Oct. 1941.
6. PESCE, V.: La bismutoterapia nelle tonsilliti acute. Dimostrazione sperimentale della rapida invasione dei tessuti tonsillari da parte dei sali bismutici. *Arch. ital. di otol.* 51: 607-612, Dec. 1939.
7. LEWIS, J. F.: Fusospirochetal organisms and tonsillitis; bismuth therapy of tonsillitis. *Arch. Otolaryng.* 35: 587-594, April 1942.
8. SILBER, S.: Treatment of tonsillitis, pharyngitis, and gingivostomatitis with bismuth salt of heptadienecarboxylic acid in cocoa butter suppositories. *J. Pediat.* 23: 59-68, July 1943.
9. SILBER, S.: Bismuth suppositories (analbis) in throat infections; bacteriology and pharmacology; effectiveness; absorption, excretion, toxicity. *J. Pediat.* 25: 244-252, Sept. 1944.

10. STOVIN, J. S.: Acute tonsillitis; treatment by rectal administration of new bismuth compound. *Arch. Otolaryng.* **39**: 259-261, Mar. 1944.
11. STOVIN, J. S.: Preoperative and postoperative care in tonsillectomy. *Eye, Ear, Nose, and Throat Monthly* **24**: 239-240, May 1945.
12. **Weekly Morbidity Reports, Shore Stations in Continental United States, Bureau of Medicine and Surgery, Navy Department. Medical Statistics Division between February 10, and December 29, 1945. Reports Nos. 163, 167, 173 through 182, 185, 186, 187, 191, 192, 196, 200, 201, 209.**



RADIOGRAPHIC STUDY OF FRACTURES OF THE CARPAL NAVICULAR BONE

JOHN L. ENYART
Captain (MC) U. S. N.

HARRY J. BROWN¹
Lieutenant (MC) U. S. N.

and

JACK B. TRUNNELL
Lieutenant, junior grade (MC) U. S. N. R.

THIS article represents an analysis from the x-ray point of view of 52 cases of fracture of the carpal navicular bone. Fifty-one patients are represented in this study, one man having sustained bilateral fractures of the bones. An additional study has been made of 17 cases in an effort to correlate the amount of motion possible with the kind of cast padding material used.

Both phases of study have been undertaken in an effort to evolve recommendations for improved treatment. There has been no effort at selection of cases. Of the total number of cases, 18 show satisfactory x-ray evidence of healing, 3 of these only after operative intervention. The same 18 patients have likewise been shown clinically to have a good anatomical and functional recovery and have been returned to full duty. Of the remaining 34, 5 are recovering from operative procedures and 6 are yet to undergo surgery. The remaining 23 patients are in various stages of healing in casts.

At this point the crux of phase 1 of this study becomes apparent. Of the 14 patients requiring surgery, 9 were first thought to be suffering only from sprained wrists. Two other patients who initially were presumed to have suffered only sprains eventually went on to satisfactory healing with prolonged immobilization. Thus it may be seen that 81.8 percent of the 11 patients in whom the correct diagnosis was not made at the time of injury eventually required surgical treatment. On the other hand, only 14.6 percent of the remaining 41 patients failed to achieve satisfactory recovery with the conventional type of immobilization.

We hasten to point out that in the foregoing figures there is no serious reflection upon the diagnostic ability of those medical officers who treated the cases at the time of injury. As a matter of fact, 8 of the 11 were x-rayed within 24 hours of their injury. The other 3 fractures occurred in areas where x-ray equipment was not available.

¹ Resigned 31 January 1947.

The observation has repeatedly been made that roentgenograms at the time of injury will fail to disclose a fracture in an appreciable number of cases. It is only after restriction of motion imposed by pain that the demineralization which takes place allows the fracture to be seen easily.

It is from the foregoing that we take justification for making the first of two recommendations.

All patients giving a history of force having been applied to the palm of the dorsiflexed hand, particularly those with evidence of sprain or fracture, however slight, and especially with tenderness in the anatomical snuff box, should be placed in a cast even though there is no x-ray evidence of fracture. The conventional position of dorsiflexion, radial deviation and abduction of the thumb should be employed. After a 2-week period, a repeat x-ray examination will almost certainly disclose the presence of a fracture if it is present. If not, the cast may be removed and no harm will have been done. On the other hand, if a fracture is present, the promptest and best possible treatment will have been instituted.

We are well aware that the location of the fracture line in the navicular bone is an important factor in determining the outcome regardless of the type of treatment. Hence, we wish to point out that the distribution of location of fracture in the group of 11 cases just considered essentially parallels that of the group at large in which 31 of the fractures were through the waist of the bone, 16 were through the proximal portion, 4 through the distal portion, and in 1 there were 2 fractures, 1 in the distal portion and 1 through the waist. In the group of 11 patients in whom the diagnosis was temporarily overlooked, 7 fractures were through the waist, 3 in the proximal portion and 1 in the distal portion. Of the 2 patients in this group who did not require surgical intervention, 1 had a fracture through the waist of the bone and the other through the distal portion.

The second phase of this study is concerned with the fluoroscopic examination of 17 of the 23 cases still in casts. Since the casts were applied by several different medical officers each preferring his own technique, there was naturally some variation in the kind of cast examined. These variations did not involve the fundamental position of the hand, wrist and forearm but were instead concerned with the make-up of the cast itself. We were primarily interested in determining whether or not immobilization of the navicular bone was possible with any type of cast. The results of this examination appear to us to be highly significant. Six of the seventeen casts were applied without stockinet and with a minimum of padding. The other 11 casts were applied with a stockinet liner and with varying amounts of felt padding and sheet wadding. In the course of each fluoroscopic examination, the patient was instructed to attempt radial, ulnar, dorsal and palmar motion of the wrist and to attempt motion of the thumb

in any direction possible. In the 6 skin tight casts, very little motion of the navicular bone was observed regardless of the type of motion attempted by the patient, except in one instance in which the terminal phalanx of the thumb had not been sufficiently incorporated in the cast. The patients wearing the other 11 casts were able to produce motion of the navicular bone up to $\frac{1}{2}$ cm. with radial and ulnar deviation and to several millimeters with dorsiflexion and palmar flexion and with motion of the thumb. Although we are aware that the distance traveled by the shadow of the fluoroscopic screen is somewhat greater than that traveled by the bone itself, we are faced, nonetheless, with the fact that some motion occurred in those heavily padded casts as against almost no motion in the skin tight casts. We are in no position to say with the data we have on hand, whether or not this motion is detrimental to healing; however, it is well known that with fractures of bones elsewhere in the body any kind of motion is detrimental to rapid healing. Hence, our second recommendation.

Casts applied for the treatment of fractures of the navicular bone should be of the skin tight variety. That is, no stockinet should be used and felt padding should be limited to the prominences over the distal portions of the radius and ulna. The terminal phalanx of the thumb should not be entirely encased but should be sufficiently incorporated in the cast to prevent any motion. The distal end of the cast should extend about 1 cm. beyond the ends of the metacarpal bones. Proximally, the cast should extend to the elbow but need not include it, though there is some evidence that prevention of pronation and supination would be desirable.

SUMMARY

A series of 52 cases of fracture of the carpal navicular bone has been analyzed from the radiographic point of view. As a result of certain findings, two recommendations have been offered in the hope that an improvement in the over-all quality of treatment of this condition may be achieved.

(1) All diagnostic methods available should be employed in an effort to rule in or out fracture of the carpal navicular when possibility of such a lesion exists. If there is any doubt as to the correct diagnosis, a cast should be applied and a repeat x-ray examination made after 2 weeks.

(2) Skin tight casts are necessary to prevent motion of the carpal navicular fragments during the healing period.



CARDIAC AND ELECTROCARDIOGRAPHIC OBSERVATIONS ON AMERICAN PRISONERS OF WAR REPATRIATED FROM JAPAN

WILLIAM M. FISCHBACH
Lieutenant (MC) U. S. N. R.

AN OPPORTUNITY for the study of 107 American prisoners of war repatriated from Japan was recently presented. The men had been interned in 1941 and early 1942 and had been subsisting on a diet deficient in all categories for a period of more than 3 years. It has long been recognized that, as Graybiel and White (1) have stated, avitaminosis and malnutrition are not common causes of important heart trouble or electrocardiographic changes. But as these men had been under such a prolonged period of malnutrition, it was considered a rather unusual opportunity to note what, if any, residual effect might be found in their hearts. It is to be borne in mind that these studies were started after the men had received from 5 to 7 weeks of adequate nutrition. The findings therefore represent a study of residual rather than the active phases of a deficiency disease.

METHOD

On admission the patients were questioned as to their diets during internment and as to any symptoms of a deficiency state manifested during that period. Subjective and objective cardiac symptomatology were noted. Each patient then received a physical examination, blood count, Kahn test, urinalysis, fecal examination, exercise test, electrocardiogram, and a chest film if this had not been previously taken. All patients were placed on high caloric diets, rich in vitamins and protein. Multiple vitamin preparations were administered and, when indicated, thiamine chloride was added. Anthelmintics were necessarily given to 47 percent of the group.

The patients were then observed for an average of 3 months. During this period symptoms persisting since repatriation were recorded, as was the ultimate alleviation or persistence of these.

At the outbreak of the war these men were members of the regular Navy and Marine Corps and thus had met the rigid physical standards

required by those services. It can thus be assumed that prior to internment they were free of any disease of serious import. The average age of this group at the time of the study was 27 years, the range being from 22 to 45.

PERIOD OF INTERNMENT

Williams and Spies (2) have pointed out that in practically all states of malnutrition in human beings, the diet, because it is deficient in several factors, may eventually produce a complex clinical picture, it following that the physician will frequently recognize two or more distinct deficiency diseases in the same person. It was observed, as we classified by history the types of deficiency disease, that most patients appeared to have a combination of two or more deficiency types.

Of the 107 patients studied 84 had sufficient symptomatology to be classified as having had a deficiency disease. Of these, 76 had beriberi, 27 had pellagra, and 3 had scurvy. The various combinations of these are shown in table 1. It is to be noted that no patients are classified as having had the cardiac, pernicious, or acute type of beriberi. Many accounts of such cases were obtained, but the victims of this fulminating type had all died rapid, if not sudden deaths.

TABLE 1.—*Deficiency diseases during internment*

	<i>Number of cases</i>
Dry and wet beriberi.....	23
Wet beriberi.....	22
Dry beriberi.....	11
Pellagra.....	7
Pellagra, dry and wet beriberi.....	7
Pellagra and wet beriberi.....	7
Pellagra and dry beriberi.....	4
Pellagra and scurvy.....	1
Pellagra, scurvy, dry and wet beriberi.....	1
Scurvy, dry and wet beriberi.....	1
Total.....	84

It was estimated that the men had been on a diet of not more than 1,500 calories daily (and frequently less), derived from 600 to 700 grams of food. The food was principally rice and barley mixtures, with soups of soya beans, kelp, onion, or turnip. Fresh fruit was rarely seen and a very small portion of fish or meat was obtained on the average of once a month.

During this period 66 patients experienced edema of the lower extremities, 45 complained of dyspnea on exertion, 11 had palpitation, 9 had frequent bouts of precordial pain, and 4 had recurrent attacks of paroxysmal tachycardia. With three exceptions these symptoms occurred in the group of patients having classifiable deficiency disease.

PERIOD OF REPATRIATION

The first observations were made approximately 5 to 7 weeks after repatriation. During this period they had received adequate vitamin therapy and a high caloric high protein diet, the quantity being limited only by their desire and ability to eat.

On admission 37 still had dyspnea on exertion, 7 were having bouts of precordial pain, 3 complained of palpitation, 4 had attacks of paroxysmal tachycardia, and one had syncopal phenomena. On physical examination 42 were found to have a persistent tachycardia and one a bradycardia, 20 had intermittent ankle edema, 9 had a poor exercise response, and 4 had extrasystoles. Two patients were found to have developed a fixed hypertension with no demonstrable renal findings, all other patients having blood pressure readings within normal limits.

The laboratory studies were not remarkable. All patients had quickly attained normal blood count and urinalysis. In only two patients was the Kahn positive. Although actual cardiomeasurement was not done, in no instance was the heart reported noticeably enlarged on the routine chest film. This may seem unusual, but it has long (3) been known that the cardiac enlargement in beriberi is reversible, and Aalsmeer and Wenckebach (4) have stated that the cardiac enlargement in beriberi is not a true hypertrophy of the muscle fibers, but is rather a colloidal imbibition of fluid, analogous to myxedema, and contrasting with the state of free fluid as in ordinary edema.

Functional systolic murmurs over the apex and at the pulmonary area were heard in five cases, but no organic murmurs in other evidences of valvular heart disease were noted.

Within 3 months, on the previously described nutritional program, all symptoms of precordial pain and palpitation had been alleviated. Likewise, all symptoms of tachycardia and dyspnea were relieved, but less rapidly than the former. One patient maintained his state of edema until the end of the tenth week, the other cases of edema clearing more quickly. Three of the four cases of paroxysmal tachycardia were totally relieved, and the fourth had only infrequent attacks. The patient with syncope had had no attacks for the month prior to discharge. The functional murmurs were considerably reduced in intensity.

It is to be noted that at the time of completion of their period of hospitalization, all patients had regained or surpassed their average preinternment weight.

ELECTROCARDIOGRAPHY

A total of 126 electrocardiograms were made on the 107 cases, 16 patients requiring two or more electrocardiograms for observation as to progress. The lead IV used in this was the IV-F type.

Slight to marked left axis deviation occurred in 16 cases and right axis deviation in 2. A tachycardia of 100 or greater was noted in 42 tracings, with a sinus bradycardia (of 35) in 1 tracing. There were 3 patients with extrasystoles, the origins being auricular, nodal, and ventricular respectively.

With the exception of the normal variations in leads III and IV, there were no remarkable findings in regard to the P-waves. The P-R interval was within normal limits in all cases.

The QRS complex showed intraventricular block in 1 case, but this disappeared within 6 weeks. There was slurring in the QRS complex in all leads in 2 patients, and there was low voltage of the complex in all leads in 1 patient. There were significantly (exceeding the amplitude of the QRS complex by 25 percent or more) large Q-waves in lead III in 3 cases. In 57 other patients there were Q-waves of 1 to 5 mm. occurring in one or more leads, but in no instance were these of sufficient amplitude to be considered important.

No marked T-wave changes in lead I were experienced. In 2 cases a diphasic T-wave in lead IV was encountered, but such may occur in normal hearts. In one patient there was a diphasic T in lead II, associated with other significant changes, but these returned to normal after 1 month. There were ST segment changes in 18 cases, representing elevations in leads II or III or IV in 13 instances, and depression in sagging of the segments in leads I or III in 5.

The electrical systole, calculated by Bazett's formula with the constant K being 0.37 (5), was found to be prolonged in 52 percent of the cases. Only cases in which the prolongation was at least 0.01 second greater than the calculated normal for that particular RR cycle were considered in this figure. It is also to be noted that these were calculated on the basis of the final tracing, which in seven patients had changed from a marked prolongation in an earlier tracing.

DISCUSSION

The cardiovascular manifestations of nutritional deficiency have been described by many observers in various parts of the world during the past 25 years. Weiss and Wilkins (6) have listed in table form 21 circulatory manifestation. All manifestation found on our patients coincide with this list with the exception of the patients with paroxysmal and tachycardia and extrasystoles. It was also noted by them that all cardiovascular disturbances usually revert to normal. In our entire series all manifestations were alleviated with the exception of one of the cases of paroxysmal tachycardia and the two cases of hypertension. Tachycardia and dyspnea were less rapidly relieved than the other symptoms.

Scott and Herrmann (7) stated that there were no characteristic or pathognomonic electrocardiographic changes. Keefer (8) has like-

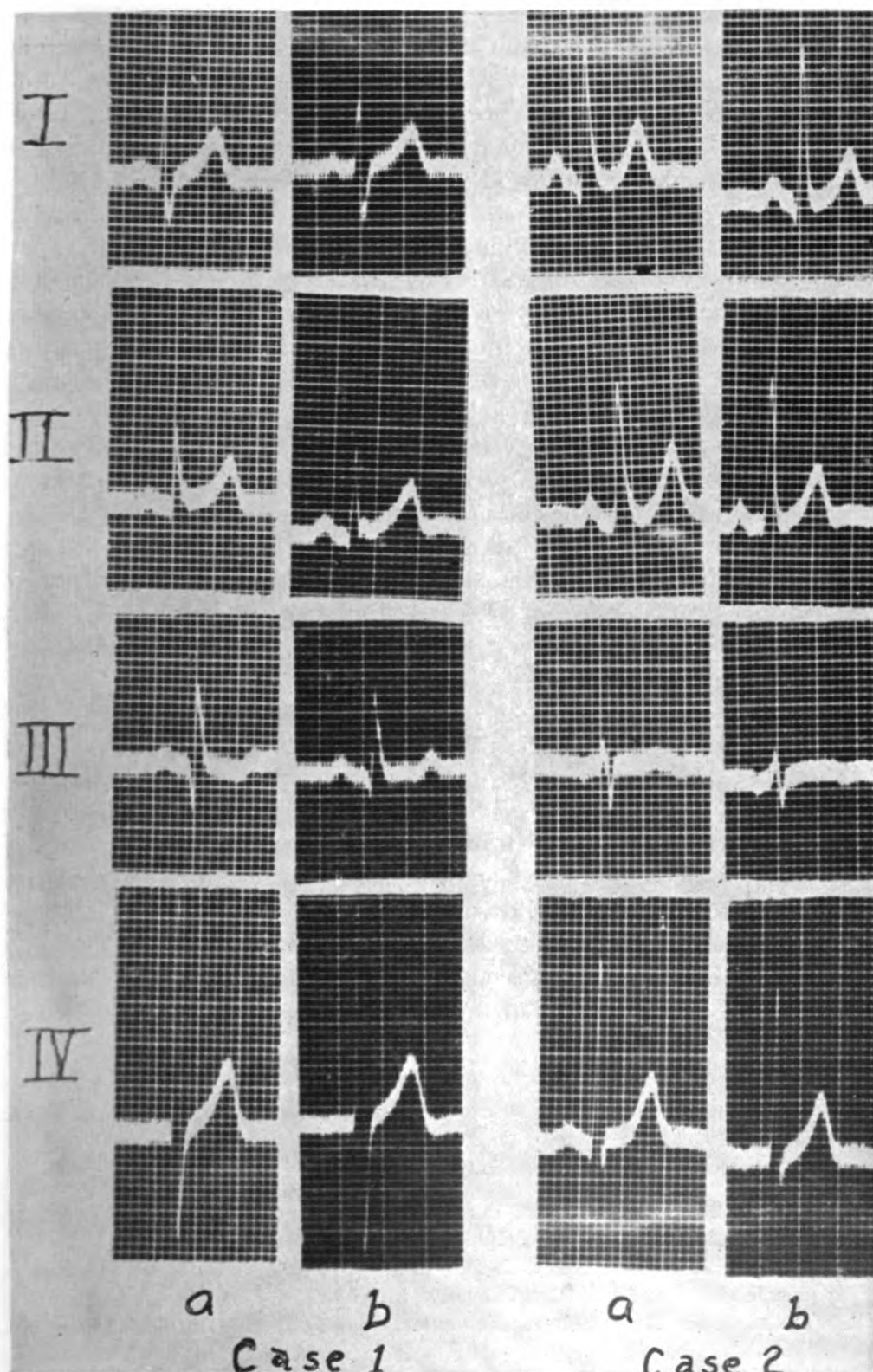


FIGURE 1.—Case 1. (a) Tracing shows Q-3 of 4 mm. (25 percent of R) with diphasic T-3; (b) tracing after 7 weeks, Q-3 reduced to 1 mm., T upright. Case 2. (a) Tracing shows QRS in leads I and II with a duration of .12 seconds; (b) tracing after 12 weeks shows duration to be .08 seconds.

wise stated that it is remarkable that there were no characteristic electrocardiographic changes from the normal. The literature abounds with a multiplicity of various findings such as negative T-1 and T-3 (7), left and right ventricular preponderance (7), T-wave changes and prolongation of the electrical systole (Q-T) (6), sinus tachycardia (9), and a Pardee type of ST with large T-waves (9). Dustin, Weyler, and Roberts (10) found that the electrocardiogram during the first week or two of treatment became more abnormal and then tended to return toward normal. The over-all picture in this study of residua seemed to be that of rather minor electrocardiographic changes. What changes were found varied widely in character. Sinus tachycardia and prolongation of the electrical systole were the most consistent findings. The ST segment changes, while frequent, were not of sufficient amplitude or consistently characteristic of the Pardee type. The three cases of significantly deep Q-waves were of interest. In only four cases were the changes of sufficient severity to warrant an interpretation of myocardial damage, and in all instances these tracings showed marked improvement within 3 months. The ability of electrocardiograms showing myocardial changes to improve is illustrated in figure 1, where significantly deep Q-waves and intraventricular block are alleviated.

SUMMARY

1. Observations were made of 107 American prisoners of war repatriated from Japan.
2. Statistics in regard to residual objective and subjective cardiac symptomatology are given. The presence of extrasystolic phenomena and paroxysmal tachycardia are unusual in such a series.
3. Electrocardiographic studies are summarized.
4. These observations conform to the generally accepted belief that malnutrition is not a cause of serious heart trouble or electrocardiographic changes.
5. It is of interest to note that after so prolonged a period of malnutrition there should be so relatively few residua of a serious nature.

REFERENCES

1. GRAYMEL, A., and WHITE, P. D.: *Electrocardiography in Practice*. W. B. Saunders Company, Philadelphia, Pa., 1941. p. 100.
2. WILLIAMS, R. R., and SPIES, T. D.: *Vitamin B₁ (Thiamine) and Its Use in Medicine*. The Macmillan Company, New York, N. Y., 1938. p. 4.
3. WALKER, J. E.: Reversible cardiac enlargement. *J. A. M. A.* 106: 1795-1796, May 23, 1936.
4. AALSMEER, W. C., and WENCKEBACK, K. F.: Herz and Kreislauf bei der Beri-beri-Krankheit. *Wien. Arch f. Inn. Med.* 16: 193-272, Jan 20, 1929.
5. STROUD, W. D.: *Diagnosis and Treatment of Cardiovascular Disease*. Vol. 1. 2d edition. F. A. Davis Company, Philadelphia, Pa., 1942. pp. 610-611.

6. WEISS, S. (Boston), and WILKINS, R. W.: Nature of cardiovascular disturbances in nutritional deficiency states (beriberi). *Ann. Int. Med.* 11: 104–148, July 1937.
7. SCOTT, L. C., and HERMANN, G. R.: Beriberi (“maladie des jambes”) in Louisiana, with especial reference to cardiac manifestations. *J. A. M. A.* 90: 2083–2090, June 30, 1928.
8. KEEFER, C. S.: The Beriberi heart. *Arch. Int. Med.* 45: 1–22, Jan 1, 1930.
9. FEIL, H.: Clinical study of the electrocardiogram and of phases of cardiac systole in pellagra. *Am. Heart J.* 11: 173–184, Feb. 1936.
10. DUSTIN, C. C.; WEYLER, H.; and ROBERTS, C. P.: Electrocardiographic changes in vitamin B₁ deficiency. *New England J. Med.* 220: 15–21, Jan. 5, 1939.



THE NAVAL STATION DISPENSARY

LEON D. CARSON
Captain (MC) U. S. N.

IN CONSIDERING the ambitious program for the postwar Navy Medical Department it is considered appropriate to inquire closely into the functions and importance of the naval station or naval air station dispensaries; the sort of medical support they offer; what they contribute to the training and experience of the Naval medical officer; and what may be done to improve the character of medical service they offer.

Since most inquiries of this sort start with a definition of terms let us first attempt to determine whether the Navy institutions broadly classified as dispensaries have been appropriately named. The following definitions of the word "dispensary" may be found in accepted dictionaries. Funk and Wagnall's Standard Dictionary gives the following definition:

Dispensary.—A place where medicines are kept and compounded; esp. where they are given freely to the poor.

Webster's Collegiate Dictionary, Fifth Edition, defines "dispensary" as follows:

Dispensary.—A place where medicines are prepared and dispensed, esp. free or at low cost to the poor.

It is obvious that any lexicographer would consider the name dispensary as it is applied to small or larger station hospitals a misnomer.

The Manual of the Medical Department of the U. S. Navy frequently refers to dispensaries and so do the various circular letters of the Bureau of Medicine and Surgery, but the writer has been unable to discover any clear definition of the functions and responsibilities of these institutions. Abraham Lincoln said that God must love the poor because he made so many of them. To paraphrase this we might well assume that the Navy must be very fond of its dispensaries because it has created so many of them.

There are at the present writing a very considerable number of naval base dispensaries, naval station dispensaries, and naval air station dispensaries in existence. Naval dispensaries range in size, equip-

ment and staff from small "sick bays" with one or two medical officers, up to large station hospitals with 500 beds, 20 or more medical officers, nurses, and hospital corpsman, both officer and enlisted, ranging into the hundred or more. These medical activities usually support large naval bases or air stations and offer diversified medical services equivalent to those available at the small naval hospital. In fact, their total responsibilities and activities often exceed those of the naval hospital. This has been notably true during the course of the recent war. In fact, in certain advance base or forward areas, the naval dispensary was often "blown up" to hospital size due to the delay in constructing and equipping fleet and mobile hospitals. The main point of differentiation was simply that the naval hospital was organized and functioned as a command with all of the responsibilities and prerogatives of a separate command, whereas the dispensary was a subordinate medical activity, although administered by a senior medical officer. It might be commented that the so-called mobile hospital was found to be the antithesis of "mobile," nevertheless, both types of institutions had their very definite usefulness and both performed their tasks well.

Since the ending of hostilities, the Medical Department of the Navy has embarked upon an extensive and commendable program to improve the character of hospital service in the Navy; to develop its larger naval hospitals as accredited teaching institutions; and to develop a corps of highly trained specialists in the various fields of medical specialization through a well-planned program of post-graduate medical training to be conducted not only in the Navy's teaching hospitals but also in civilian medical schools, hospitals and clinics. This program will undoubtedly improve the character of specialized medical service available within the naval hospitals and will make appointments of medical officers to the naval hospitals eminently desirable and much sought after. But the question which occurs to the writer is simply this: Have we achieved thereby a complete program for the improvement of medical service throughout the Navy? Will the well-trained medical specialist be assigned to our naval dispensaries and if he is so assigned, will dispensary practice offer him an opportunity to make his specialized training fully available to the naval service and will medical officers assigned to duties at naval dispensaries be offered sufficient incentive and encouragement to continue to develop themselves within their specialities?

Such specialized fields of medicine as aviation medicine, industrial medicine and industrial hygiene, sanitation, epidemiological control, and venereal disease control must of necessity remain the responsibility of the dispensary. However, the dispensaries must and will continue to serve as the Navy's primary diagnostic centers; must continue to

diagnose and treat diseases and injuries not requiring specialized hospital treatment; and must make the decision as to whether hospitalization is indicated or warranted in each individual case. The work of the naval dispensary is important and is the real basis of the medical service offered by the Navy to all of its personnel. Most of the sick and injured of all Navy shore-based activities are seen and treated in its dispensaries. Relatively few are referred or transferred to a naval hospital.

Just as the adequacy of medical care of a civilian community depends upon its well-trained and efficient general practitioners, so does the adequacy of the medical service offered the Navy depend largely upon its general practitioner type of medical officer both in the fleet and ashore. Hospitals cannot offer the Navy a complete and adequate medical service. Hospitals treat relatively few of the Navy's sick and injured personnel.

There is this important difference between the civilian practitioner and the fleet or dispensary doctor—the civilian practitioner is privileged to follow his case into the hospital where specialized consultative service is available, whereas, this privilege is not readily available to the medical practitioner in naval dispensaries or aboard ship. When a civilian general practitioner refers a case to the specialist that specialist keeps him fully informed as to diagnosis, treatment and progress of the patient. This courtesy could be rendered by the specialist in a naval hospital, but unfortunately this highly desirable liaison is seldom realized. In fact quite recently, the writer transferred a seriously sick officer showing meningeal symptoms following a few days of illness, to a naval hospital where the patient developed a bulbar paralysis and died within 24 hours. Autopsy established a diagnosis of acute bulbar poliomyelitis. The transferring dispensary was not informed by the naval hospital and heard of the patient's death and diagnosis quite fortuitously, and this, in spite of the fact that the diagnosis was of epidemiological significance to the command effecting the transfer.

It is a well-known fact that naval patients transferred to naval hospitals are not returned to duty as promptly as in cases where the dispensary treats the same patient. Certain admitting and diagnostic routines employed in naval hospitals apply to all patients admitted regardless of diagnosis or severity of the illness; and without reference to the fact that in many cases these routine laboratory procedures had been accomplished immediately prior to admission to the hospitals. In handling large numbers of patients in hospitals certain laboratory procedures are accomplished on certain days of each week, and consultations with staff specialists are likewise available only on certain days of the week. It is also common practice for patients fully

recovered and ready for duty to be kept in the hospital to be released on some particular day each week, such as a Friday or Thursday. These are all problems of hospital administration and no doubt some of these matters are capable of correction. Some of our hospital administration practices are too inflexible and tend to defeat the Medical Department's declared objective—"to keep as many men at as many guns as many days as possible." It is significant that criticisms regarding unnecessary delays in handling of patients are very infrequently directed at our dispensaries.

It is the writer's conviction that if given adequate support, our larger station dispensaries could treat a large percentage of the patients now being transferred to naval hospitals; that they could maintain the same high professional standards; and that they could perform this service with less lost motion or unnecessary delays than is entailed by transfer of most patients to naval hospitals. In short, some of our larger naval dispensaries are designed and fully equipped to render a complete medical and surgical service and did so during the recent war. Now, due to apparent shortages in hospital corps, and nursing personnel, these station hospitals are reduced to the status so well defined by the word "dispensary"—i. e., "place where medicines are kept and compounded and dispensed, esp. free or at low cost to the poor." At the same time an attempt is being made to maintain a considerable number of large naval hospitals within the continental limits of the United States; all of them requiring fairly complete medical and nursing staffs, and many of them only partly filled with patients. It is the belief of the writer that a number of our present continental naval hospitals could be decommissioned, and the medical, hospital corps, and nurse corps personnel be redistributed to our larger dispensaries. This would result in a more adequate medical service to Navy shore establishments and shore-based fleet supporting units than is possible under the present distribution of our Medical Department personnel.

If our larger dispensaries were to be set up as station hospitals, and adequately staffed on the group clinic plan there is no doubt that a considerable part of the patient load now being transferred to nearby naval hospitals, could be handled by them. This would give medical officers assigned to such "station hospitals" an opportunity to continue to advance themselves professionally, within their elective specialties and would make such duty much more attractive to them. And finally, it would result in a more complete medical service to the various naval commands served by these large dispensaries. Fewer consultations would be required of naval hospitals and only the more seriously sick or injured would be admitted by transfer to the hospitals. Patients whose return to duty could be estimated to be within two or

three weeks could be treated locally; others requiring longer periods of treatment and action by boards of medical survey would be admitted and transferred to the nearest naval hospital.

The number of naval hospitals required under such a program would be somewhat less than under our former or our existing methods of management but this would be compensated for by the higher professional standards and opportunities accruing to the medical officers outside the naval hospitals. It is believed that such a plan as proposed in this discussion merits the serious consideration of the Bureau of Medicine and Surgery.



A STUDY OF 200 VIOLATORS OF GENERAL COURT-MARTIAL PROBATION

WILLIAM C. B. JOHNSTON
Commander (MC) U. S. N. R.

and

H. ROBERT OTNESS
Lieutenant Commander H(S) U. S. N. R.

PROBABLY the most serious aspect of the naval disciplinary problem is that of recidivism. Personnel assigned to disciplinary barracks are well aware of this problem. Probably personnel of the psychiatric units meet the impact of recidivism more clearly since all naval offenders admitted have contacts with the psychiatric office.

Considerable interest has been shown in attempts to salvage residual manpower among the more serious naval offenders through the establishment of retraining commands for general court-martial offenders. There is yet much to be done in attempting to understand the first offenders and the recidivist for petty offenses to keep these men from becoming general court-martial cases. Confinement and court-martial procedures apparently are not the answers since these seldom alleviate the motivations back of the naval offender.

Recidivism is a serious problem and one that costs the Navy vast sums in dollars and in manpower, including that of the enlisted men confined and the enlisted men and officer manpower to care and maintain disciplinary barracks and retraining commands.

Recidivism, if not checked or its solution not determined early, will ultimately result in the general court-martial procedure—a very expensive procedure for all concerned.

This article is a study in recidivism as exemplified in 200 enlisted men who had finally been awarded a general court martial after several previous offenses, and served time and who were later restored to duty on probation and who subsequently broke probation by another offense which required further disciplinary disposition.

The term probation as used in the Navy is practically synonymous with the term parole as used in the civilian sense implying that a man who has been an offender has been returned to duty and on trial with some kind of suspended sentence over him.

Since each of these men had been interviewed by two or more members of the psychiatric office, considerable data were collected on them and form the basis for this article. A follow-up on the recommendations made by the psychiatric office is also reported to the extent of available data.

It is felt that were the motivations for the recidivism completely understood by the personnel in charge of these men, the ultimate general court martial and discharge from the service might have been avoided in certain cases, or the discharge from the service brought about sooner thus alleviating the prolonged expense.

Recidivism intimates a twofold probability: (1) that of the shortcomings of the man himself, and (2) that of the failure of the naval personnel to fully understand the man and the motivations. The clash of these misunderstandings often results in a naval recidivistic offender. The difficulties involved herein are well recognized.

The 200 probation violators considered herein were studied with the attempt to determine if possible any prognostic symptoms or traits that would aid in predicting the success or failure of the general court-martial offenders when released, or prior to release on probation or parole.

Much of the data to be used have been taken from a special questionnaire¹ filled out by the offenders themselves supplying information about their naval history, nature of present and previous offense, family background, marital status, educational achievement, civilian delinquency records, physical health status, stability, personal problems, and attitudes in the Navy.

The clinical interpretation and significance of biographical data in the understanding of human behavior in its development are well recognized by psychiatrists and psychologists who are trained to deal with human beings.

The data and discussion that follow aim to describe the backgrounds of these 200 men, presenting first certain data that have bearing on their personal life and civilian status.

Table 1 presents the geographical distribution of these men by home States. The number are somewhat influenced by the fact that the disciplinary barracks serves several Southern States.

A tabulation of religious preferences indicated that 136 (68 percent) were Protestant; 54 (27 percent) Catholic; 2 (1 percent) Jewish; 5 (2.5 percent) none; and 3 (1.5 percent) others. The data indicate that this factor has little or no bearing on the present problem under investigation.

¹ JOHNSTON, W. C. B.; OTNESS, H. R.; and STOFFER, G. A. W., JR.: Method of psychological screening of naval offenders. *Mil. Surgeon* 97: 300-306, Oct. 1945.

TABLE 1

State	Num- ber	State	Num- ber	State	Num- ber
Arkansas.....	1	Maryland.....	9	Rhode Island.....	2
California.....	1	Massachusetts.....	7	South Carolina.....	10
Connecticut.....	2	Michigan.....	6	South Dakota.....	1
Delaware.....	3	Mississippi.....	3	Tennessee.....	12
Florida.....	2	Missouri.....	2	Texas.....	4
Georgia.....	4	New Jersey.....	9	Virginia.....	11
Illinois.....	4	New York.....	28	West Virginia.....	9
Indiana.....	7	North Carolina.....	27	Washington.....	1
Iowa.....	2	Ohio.....	5		
Kentucky.....	6	Pennsylvania.....	18	Total.....	200
Louisiana.....	4				

Age.—The age distribution of these men revealed that the average or mean age was 22.12 years, median 20.77 years, and mode at 19 years. The age range extended from age 16 to 17 up to and including 36 to 37 years, being somewhat skewed toward the younger ages as would be expected.

Family background.—The following briefly summarizes some interesting facts concerning the family and home status. The impact of these factors in shaping their lives is well recognized by psychiatrists and psychologists. It is equally important in understanding the actions of naval offenders since home attachments play such a large role in the motivations for offenses.

Of these 200 men there were 51 (25.5 percent) whose fathers were not living and 37 (18.5 percent) whose mothers were not living. Thirty-five (17.5 percent) of the families were divorced or separated. Twenty-two cases reported a stepfather living and 16 a stepmother living. There were 49 (24.5 percent) who reported that they did not have happy homes as boys growing up. Seven were raised in an orphanage or foster-home.

The influence of home instability in the personality adjustment of civilian delinquents is well known and may be just as real with the offenders in the Navy where this factor has perseverated.

These 200 men were from families where they had brothers and sisters ranging from none to 9. There were 425 brothers, 445 sisters, 52 half brothers and 51 half sisters, a grand total of 973 siblings or at an average rate of 4.8 per man. There were 12 "only children" and 2 "only children" with half siblings.

This factor in relation to the parental situation may explain the poor adjustment in the Navy of certain men who are obligated to care for a family.

Educational background.—The highest grades completed and reported by these men ranged from 3d through 14th or sophomore in college. The mean or average grade of schooling was 9.3, median being 7.6 and the mode at 8th. This compares well with that of 1,000 unselected naval offenders.

The total number of grades completed for the group was 1,640 and the total time spent in school in completing these grades was 1,859 years, revealing an educational progress retardation of 219 years or at about 1.13 years per person.

Thirty-five percent of these men reported that they did not learn well in school and 42 percent stated that they "played hookey." These data indicate some early manifestations of instability and nonconformity to a routine related both to mental and personality aspects.

Reasons for quitting school.—The various reasons stated were reclassified into the groupings shown in table 2.

TABLE 2

To work.....	118	Difficulty in learning.....	4
Economic.....	18	Lack of interest.....	15
Financial.....	6	Illness and nervousness.....	3
Death of parent.....	3	To get married.....	2
Illness of parent.....	1	Graduation.....	6
Separation of parents.....	1	"No reason".....	4
Delinquent aspects.....	3	No information.....	2
To join armed forces.....	2		
To join CCC.....	2	Total.....	200

From table 2 it becomes quite apparent that the pressure of home problems has been experienced by many of these men early in life. It is also recognized that there is a tendency to project the reason for poor school success on the home situation.

Civilian delinquency.—That many of these men had had difficulty in adjustment in civilian life prior to the Navy is indicated by the data in table 3. Fifty-eight percent of these men showed early delinquent tendencies through truancy.

TABLE 3

	Cases		Times
	Number	Percent	
Played hookey.....	116	58	
Trouble with cops.....	44	22	
Juvenile courts.....	32	16	
Arrested.....	71	35.5	381
In jail.....	53	26.5	335
In reform school.....	6	3	7
In civil prison.....	5	2.5	5

It is noted that of the 71 men who reported arrests there were at least 381 arrests reported or at a rate of 5.3 per man. The number of times ranged from 1 to 75. The 53 who had been in jails had been in a total of 335 times or at a rate of 6.3 times per man. Number of times ranged from 1 to 75.

These data indicate that with many of these men that some form of delinquent attitude or behavior has perseverated in their character

since childhood and it is no special surprise that maladjustment in the naval service has resulted.

Traits of the psychopathic personality type are observed in the listing (table 4) of the kinds of civilian offenses reported by the man himself. This list as reported by the men themselves is assumed to be very incomplete but it does give a general cross section of the offenses committed. Ninety-three offenses are reported and thirty-eight kinds.

TABLE 4.—*Summary of civilian offenses reported*

Offenses against the person:		Miscellaneous offenses—Continued.	
Fighting.....	1	Drunk and disorderly.....	2
Assault and battery.....	1	Late hours.....	1
Drunk and fighting.....	1	Investigation.....	1
Fighting in movies.....	1	Bad conduct.....	1
Rape and stealing.....	1	Gambling and fighting.....	1
Hit and run.....	1	Drinking.....	6
Offenses against property:		Hauling liquor and drunk.....	1
Stealing bicycle.....	1	Drunk and reckless driving.....	3
Robbing and stealing.....	1	False arrest.....	1
Stealing.....	7	Jail breaking.....	1
Stealing and drunk.....	1	Speeding.....	6
Burglary.....	2	Driving without license.....	1
Receiving stolen goods.....	1	Running away from home.....	3
Breaking and entering.....	2	Truancy.....	2
Larceny.....	1	Reckless driving.....	3
Robbery.....	2	Bad check.....	1
Steal car.....	1	Disorderly conduct.....	3
Entry.....	1	Breach of peace.....	1
Miscellaneous offenses:		Juvenile delinquency.....	1
Drunk.....	18	No draft card.....	1

Marital status.—Of these 200 cases there were 87 who were married with 44, or 51 percent, of them with a total of 91 children or at the rate of 2.06 per marriage. Forty-three, or 49 percent, have no children reported. Of this married group 65, or 74 percent, reported being happily married while 22, or 26 percent, were not. Ten men reported they were divorced or separated.

PREVIOUS MILITARY BACKGROUND

TABLE 5

	Number	Type of discharge		
		Honorable	Dishonor- able	Bad con- duct
Navy.....	2			2
Army.....	4	4		
Merchant Marine.....	1	1		
CCC.....	23	16	7	
National Guard.....	1	1		
Total.....	31	22	7	2

Table 5 summarizes the types of previous military service these men reported along with the type of discharge obtained. These data indicate the poor adaptation that some of these men have made previously to military life and has a bearing on their present adjustment in the Navy. Thirty men reported 31 previous military services.

Naval background

Status.—Thirty-five, or 17.5 percent, of these men were Regular Navy and 165, or 82.5 percent, were Reserve. Of these 117, or 58.5 percent, were enlisted while 83, or 41.5 percent, were drafted. These figures are probably not too significant in the analysis of the offender when the proportions are considered for the total Navy.

Distribution by rates.—Of the 200 cases there were 194 who were in the nonrated branch of the Navy while 6 men were rated. (See table 6 for distribution.)

TABLE 6

Nonrated	Number	Percent	Rated	Number	Percent
S2c.....	160	80	GM3c.....	2	1.0
S1c.....	6	3.0	CM3c.....	1	.5
F2c.....	14	7.0	SC3c.....	1	.5
F1c.....	3	1.5	SSMC3c.....	1	.5
StM3c.....	1	.5	MM2c.....	1	.5
StM2c.....	8	4.			
HA2c.....	2	1.0	Total.....	6	3.0
Total.....	194	97.00			

That the nonrated men predominate may suggest some psychological factor in the field of incentive. The importance of proper classification of men in accordance to their abilities and interests need not be elaborated upon here. This is a fundamental consideration in human engineering. The nonutilization and nonrecognition of a sailor's talents often lie at the bottom of a disgruntled sailor's attitude.

Analysis of service (in months).—Due to revisions of the questionnaire used in obtaining information on these men, complete data were not available on the break-down of the months of sea duty and over-sea shore duty. Table 7 presents a cross section of these data revealed by the data so obtained.

The mean or average length of service for these men was 22.4 months, with approximate range from 8 to 84 months.

The mean length of sea duty was 10.2 months for a sample of 46 men, the range being from 2 to 46 months.

A sample calculation on 67 men indicated an average of 15.1 months spent on shore in the United States.

TABLE 7.

Months	Distribution of service (months)			
	Total months in service	Months sea duty	Months on shore, U. S. A.	Months overseas shore duty
84.....	1			
74.....		1		
68-70.....	1			
65-67.....				
62-64.....				
59-61.....	1			
56-58.....				
53-55.....				
50-52.....	2			
47-49.....	3			
44-46.....	1	1		
41-43.....	1			
38-40.....	4			
35-37.....	5	2	1	
32-34.....	10		1	
29-31.....	20	1	3	
26-28.....	10	1		1
23-25.....	22	1	4	
20-22.....	26		5	
17-19.....	19	3	5	
14-16.....	28	1	15	
11-13.....	37	2	13	1
8-10.....	9	6	16	
5-7.....		10	3	1
2-4.....		18	1	2
0-1.....		1		
0.....		19		62
Total.....	200	67	67	67

Highlights of sea duty.—The data in table 8 briefly summarizes some factors relative to the nature of the sea duty. In individual cases these factors are significant in understanding the motivation back of offenses. Experience with naval offenders has found that many offenders are victims of some residuals of combat or operational neurosis and they have run away from the aggravating factors.

TABLE 8

		Number			Number	Percent
In combat?.....	{Yes.....	62	Shore battery?.....	{Yes.....	19	9.5
	{No.....	138		{No.....	181	90.5
Where?.....	{Atlantic.....	43	Ship hit?.....	{Yes.....	20	10
	{Pacific.....	15		{No.....	180	90
	{Both.....	4	Sunk?.....	{Yes.....	5	2.5
With enemy ships?.....	{Yes.....	19		{No.....	195	97.5
	{No.....	181	Survivor?.....	{Yes.....	6	3
Enemy subs?.....	{Yes.....	45		{No.....	194	97
	{No.....	155	Survivor leave?.....	{Yes.....	4	2
Enemy planes?.....	{Yes.....	32		{No.....	196	98
	{No.....	168				

Place of present offense.—It is of interest to note that of these 200 offenders there were 31 who committed their last offense and broke probation from a ship and 169 from some shore station. This is partly due to the fact that men are not always accepted well back aboard ship after being an offender and this is very contrary to the rehabilitation efforts that are made with them while ashore. The policy of restrict-

ing men from liberty at shore stations after they have been released from long confinement also explains many of these probation violators.

Summary of previous offenses.—This section summarizes briefly the number of offenses reported by the men on the questionnaire. It is felt that this number is a bare minimum and that it is very likely that there are many petty offenses that were not listed.

These 200 men reported 702 offenses on their records or at an average of 3.5 offenses per man. One man reported 16.

The great costs of the courts martial and confinements alone with this group of men need not be elaborated upon for their significance. The problem and cost of naval recidivism are evident from the figures reported in table 9. These data, indeed, raise the great importance of analysis and treatment of first offenders with the hope of alleviating the underlying motivations to forestall recidivism in the Navy.

TABLE 9.—*Summary of total offenses reported*

Number of offenses	Number of cases	Total offenses
16	1	16
8	1	8
7	3	21
6	7	42
5	29	145
4	46	184
3	60	180
2	53	106
Total.....	200	702

Physical and health complaints.—With confined men it is not surprising to find a preponderance of complaining men. It is recognized that many of these complaints are organically justified. It is also recognized that many are psychosomatic in type precipitated by the demands and restrictions of the confinement. Men frequently resort to complaints to avoid duty and work as well as to satisfy their craving for some sort of sympathy and individual consideration as an attempt to rationalize and minimize their offense and confinement on a pity basis.

Of the 200 men herein studied 115 of them registered physical and health complaints when admitted to the disciplinary barracks. A total of 178 complaints of 52 kinds were reported. The list suggests both the organic and psychogenic factors. Sick call privilege is extended to all men.

A sampling of men revealed that approximately 40 percent reported a history of operations, serious illnesses and accidents. There were 45 percent who reported trouble sleeping and 52 percent who considered themselves as nervous persons.

Attitudes in the Navy.—Certain deductions about the personality of these men can be made from the analysis of the attitudes expressed toward the Navy. This is an important factor in understanding recidivism. Whether or not the Navy is responsible for these attitudes is a moot question. In any event the reshaping of antagonistic attitudes is a difficult problem and has many naval administrative implications. The force of attitudes in relation to efficiency is a well recognized factor.

TABLE 10

		Number	Percent
Like Navy?.....	Fine.....	53	26.50
	Fair.....	104	52.00
	Not at all.....	43	21.50
Like duty?.....	Fine.....	40	20.00
	Fair.....	85	42.50
	Not at all.....	75	37.50
Getting along?.....	Fine.....	11	5.50
	Fair.....	61	30.50
	Not at all.....	128	64.00

Reasons stated for breaking probation.—From a prognostic point of view the reasons or motivating factors back of breaking probation are very important considerations in the salvage of naval offenders. Some of these men reported multiple reasons. The reliability of these reasons might be questioned in individual cases. There were 212 reasons reported from 192 men. Eight men gave no reason.

The reasons were grouped into three classes on the basis of what seemed to be the immediate causes, namely, (1) home and family; (2) personal or self; and (3) the Navy.

The groupings strongly indicated the pressure of home and family (44 percent), and personal or self (33 percent), while the Navy accounted for about 23 percent of the reasons.

These trends suggest the need of giving these factors their full reliable significance in the handling and restoring to duty of this group of men.

Very often the confinement with its accompaniment of loss of pay and the allotment to the family merely aggravates the causes for recidivism when it is associated with home and family adjustment problems. Since the pressure of home problems is greater than the sense of duty, it is not surprising to have men break probation through becoming disgusted and disgruntled alone.

Personal or self reasons are often on a neurotic or psychoneurotic basis which are not unusual observations among the psychopaths and the emotionally unstable.

The reasons grouped under the Navy suggest problems in the fields of classification and assignment and the impact of administrative policy toward these men.

The reasons given are shown in table 11 under their respective headings.

TABLE 11

Home:		To see girl friend.....		2
Family illness.....	28	Sexual deprivation		3
Family deaths.....	1	To visit brother.....		1
Marital disharmony.....	10	Can't stand crowds.....		1
Home conditions.....	19	Assault and robbery.....		1
Homesick for family.....	33	Join Merchant Marine.....		1
Financial	1	Physical health.....		11
Personal or self:		Navy:		
Drinking	23	No liberty.....		26
Disgusted	2	Refused emergency		1
Overslept.....	3	Wants BCD.....		1
Disobedience	1	Wants sea duty.....		3
Personal	2	Mistreatment.....		7
Fear of sea.....	8	To get out of Navy.....		6
Missed train.....	3	Did not want oversea duty....		1
Theft	1	Dislike duty		3
To have good time.....	4	Dislike Navy.....		1
To get married.....	3			

Psychiatric evaluations.—As has been stated previously each of these men had been interviewed by at least two members of the psychiatric office. An evaluation of the total man was made relative to his value for the naval service. Since the interviews often revealed a history loaded with instability and psychopathy, it became obvious that many of these men should not have been restored to duty following their confinement by sentence of general court martial.

The psychiatric evaluations and recommendations made on these men following their breaking probation indicated that 176 or 88 percent were of no or little additional value to the Navy while 26 or 12 percent were considered of sufficient value to recommend restoration to duty for another trial.

The impression obtained from interviews with naval offenders suggested the futility of confinement in reshaping many of these men into valuable material for good naval service since confinement does not alleviate or eradicate the motivating recidivistic factor.

It is again emphasized that these psychiatric evaluations with recommendations were made prior to the Captain's Mast for the offense that broke the probation.

Outcomes of Captain's Masts.—Each of these 200 men appeared at Mast for the offense that broke the probation. The outcomes or "read offs" of the courts are summarized in table 12.

From the table it is noted that 17 men were handled by an additional court less than a general court martial and were restored to duty. Thirty-two men were ordered to serve additional time and then restored to duty. Hence, from the 200 cases there were 49 cases who

ultimately were restored to duty. This would indicate that about 75 percent of naval offenders violating probation on a general court martial are judged by the courts as poor material to restore to duty while the psychiatric evaluations places this at 88 percent. The further adjustment of these men when restored to duty is not known at the time of this study, hence the reliability of the judgments and evaluations of the courts are not known. Many of the men were still serving time while this study was being completed.

TABLE 12.—*Summary of dispositions following the Captains' Mast*

Sentence	Dishon- orable discharge	Bad con- duct dis- charge	Proba- tion re- voked	Proba- tion and back to duty	SCM	Deck	Mast	Total
Years:								
15.....	1							1
4.....	4							4
3.....	36	3						39
2½.....	2	1						3
2.....	27	12						39
1½.....	1	4						5
1.....		3						3
Months:								
11.....								
10.....		1						1
9.....		1		2				3
8.....		2		1				3
7.....				7				7
6.....				9				9
5.....		1		6				7
4.....				6				6
3.....		1		1				2
			50		3	3	10	66
Total.....	71	29	50	32	3	3	10	198

NOTE: 1 case had escaped, and 1 case was dismissed.

SUMMARY AND CONCLUSIONS

This study has been an attempt to unfold some prognostic factors from the backgrounds of 200 General Court Martial cases who had broken probation that might be helpful in the selection or recommendation of future cases who are serving time on General Court Martial offenses and are being considered for restoration to duty. The conclusions strongly indicate that there is no single factor, or even a group of selected factors, that can be used with 100-percent prediction. The aura of the interview, the evaluation of the total personality of the man by trained interviewers in relation to the facts of the background have a greater predictive value. However, the factual side of this study suggests the following as important considerations in deciding against restoring a violator of a General Court Martial probation back to duty:

1. *Home background*.—Unstable home with large families; disharmony between parents; separation and divorce; unsatisfactory foster home placements.

2. *Marital*.—Disharmony; inadequate wife to cope with family problems; unfaithfulness on part of wife and neglect of children.

3. *Civilian delinquency*.—Background of truancy, juvenile courts, reform school experience, civilian arrests.

4. *Educational*.—Poor school success because of poor adjustment to routine; mental subnormality and subsequent frustration in Navy; poor utilization of good ability and training by Navy in relation to classification and assignment.

5. *Rates*.—Lack of ambition to progress after long time in Navy. (This must be carefully considered in relation to policy of quotas and complements.)

6. *Sea and combat duty*.—The emotional impact of prolonged tension at sea and combat, exhaustion, apprehension, and other neuropsychiatric symptoms, including anxiety from separation from family. (Shore duty is good therapy for such a person.)

7. *Recidivism*.—Repeat offenders with poor motivation or with home problems that cannot be alleviated by the Navy to the satisfaction of the man.

8. *Physical*.—Chronic complainers with psychoneurotic complaints given as reasons for offense.

9. *Attitudes*.—Poor or antagonistic attitudes toward the Navy prior to the General Court Martial.

10. *Psychiatric evaluation*.—This over-all evaluation by experienced professional people considers these factors and many others in relation to the problem.



COTTON KNOTS

RALPH L. BYRON, JR.

Lieutenant, junior grade (MC) U. S. N. R.

IT IS usually stated that when cotton is used no attempt need be made to obtain a true square knot by crossing hands, and the suture may be cut "on the knot." This is in contrast to the teaching concerning catgut which emphasizes crosshanded squaring of all knots and leaving the cut end "long."

In one of the operating rooms of a Marine field hospital during the Okinawa campaign, cotton was used as basic suture material. It was noted at the operating table that all too frequently the 3-knot tie had a disconcerting way of untying when a sudden strain was placed on the suture. Following the campaign it was decided to run a test on cotton knots. This was carried out on a thread tester made in the field.

In order to reproduce in vitro the strain on a knot in vivo, thread was tied around a can and the thread removed from the can by cutting the portion opposite the knot. The thread including the knot was put in the thread tester in such a way that the pull on the knot was the same as in the tissues. During the course of the experiment no significant difference was noted whether the thread was wet or dry.

TABLE 1.—*Comparison of types of cotton suture*

Cotton	Tensile units		Double/ single
	Single	Double	
No. 60	3 $\frac{1}{2}$	8 $\frac{1}{4}$	2.33
No. 40	5 $\frac{1}{2}$	12	2.18
No. 30	8 $\frac{1}{2}$	18 $\frac{1}{2}$	2.18

¹ Each value = average of 10 tests.

A comparison of the three types of cotton used (table 1) shows the progressive increase in the tensile strength as the size of the cotton is increased. It is interesting to note that doubling the thread produces slightly more than twice the tensile strength. This is in agreement with the ordinary clinical impression.

TABLE 2.—*Effect of knot on strength of thread*

Size of cotton	Tensile units		c Knot/ s Knot
	s Knot ¹	c Knot ²	
Single No. 60.....	3½	2½	0.67
Double No. 60.....	8	6½	.78
Single No. 40.....	5½	4½	.82
Double No. 40.....	12	8½	.69
Single No. 30.....	8½	7	.82
Double No. 30.....	18½	12½	.68

¹ s Knot=without knot.² c Knot=with square knot that did not slip.

In table 2 we see that the presence of a well-tied square knot in the thread weakens it by 18 to 33 percent. The thread always breaks at the knot. In judging the strength of a thread, a surgeon will often test it by breaking it. However, as soon as a knot is placed in the thread it is weakened by a significant amount.

TABLE 3.—*Effectiveness of the knot*

Type of knot:	Percent coming untied
1-hand 3 knots uncrossed, cut on knot.....	100
1-hand 3 knots uncrossed, cut 1 mm. from knot.....	75
2-hand 3 crossed square knots, cut on knot.....	60
2-hand 3 crossed square knots, cut 1 mm. from knot.....	30
1-hand 3 uncrossed knots, cut 1½ mm. from knot.....	50
2-hand 3 crossed square knots, cut 1½ mm. from knot.....	0
1-hand 3 uncrossed knots, cut 2½ mm. from knot.....	40

NOTE.—Each percentage was obtained from 40 tests.

It is seen from table 3 that the usual one-handed knot, where no effort is made to square it by crossing the hands, when it is cut on the knot, is completely unreliable. Nor is it enough just to make certain of a square knot by crossing hands and then cutting on the knot. To get a satisfactory knot the hands should be crossed, assuring a square knot, and the thread cut 1½ mm. from the knot. When the knot is observed under tension, the square knot slips ½ to 1 mm. as tension is applied. When a knot unties it may do so under 10 to 90 percent of the tensil strength of the thread with a good knot. This unpredictable variability makes the poor knots very dangerous.

CONCLUSION

1. The tensil strength of cotton is roughly proportional to the size. Double thread is slightly more than twice as strong as single thread.
2. The presence of a knot in a thread weakens it by 18 to 33 percent.
3. A satisfactory knot with cotton which will not untie in the tissues should be 3 square knots made by crossing hands and cut 1½ mm. from the knot.



THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



ADVANCES IN THE TREATMENT OF PARAPLEGICS

One of the outstanding advances to come out of the medical experiences of World War II was in the field of spinal cord injuries. The distressing and crippling bladder symptoms led the urologist to be particularly concerned with these cases. The striking results reported by Gershom Thompson, of the Mayo Clinic, and his colleagues Nourse and Bumpus are among the most notable contributions, perhaps the most notable contribution in urology during the war years.

Much of this work was done in naval hospitals during the later period of World War II and immediately following it. The report made on a series of 101 cases of cord injury or disease made by Thompson, Nourse and Bumpus at the 1946 meeting of the American Urological Association shows some remarkable results. There were 126 operations done on the 101 cases. Of these, 79 were transurethral sections.

It must not be assumed, however, that the exceptional results were due to this single procedure. Decubital ulcerations were covered by plastic surgery, protein losses from tissue exudation prevented and dietetic means taken to maintain nutrition at a high level. The use of sulfonamides, penicillin, and streptomycin, transfusions, and other measures were important. Among neurological operations, there were 53 laminectomies alone, with a total of 121 neurological operations.

The results as to vesical functions with 99 living patients in this series, 93 had vesical function without a catheter or tube. Of this number, 53 had a voluntary type of urination and 40 reflex automatic micturation at 3- or 4-hour intervals.

Satisfactory bladder functioning and the elimination of infection were the main objectives attained by Dr. Thompson and his associates. For the patient to remain dry and the urine crystal clear is the most satisfactory result that can be expected. The urologist cannot do this alone but must have the help of the neurosurgeon, the orthopedic

surgeon, the physical therapist, and the nurse. The development of this teamwork is one feature of the work and the results. Another is the use of adequate full drainage of the neurogenic bladder. Another is the surprising effects of late laminectomy and débridement of the cord area by removal of spicules of bone, foreign bodies or the damaging material in pressure. With all these things, results never reached before with so large a series were attained.



ARTICLES OF SPECIAL MERIT PUBLISHED IN THE U. S. NAVAL MEDICAL BULLETIN DURING 1947

For a number of years it has been the custom to select from the articles published in the U. S. NAVAL MEDICAL BULLETIN during the calendar year a few (usually three or four) which are considered to be particularly excellent both in material and in preparation for publication. During the past 4 years, this practice has fallen into desuetude. It is now being revived, and there is listed below the titles of the articles and their authors that were selected during 1947 as being especially meritorious:

Title	Author	Month
The Plastic Ocular Prosthesis.....	Nilranen, John V., Comdr. (DC) U. S. N.; Sears, Gordon H., Civillian Assistant, aided in the preparation of this article.	January-February
Medicine at the Crossroads	Draeger, R. Harold, Capt. (MC) U. S. N.; Warren, Shields, Capt. (MC) U. S. N. R.	March-April
Repair of Soft Tissue Defects of the Foot	Hamm, William G., Capt. (MC) U. S. N. R.; Hardy, S. Baron, Lt. Comdr. (MC) U. S. N. R.	March-April
Yaws Treated With Single Massive Doses of Penicillin.	Arje, Sidney L., Comdr. (MC) U. S. N	November-December
Emotion, the Etiologic Relation to Ill- ness.	Caveny, Elmer L., Capt. (MC) U. S. N.....	May-June
Reconstruction of the Thumb.....	Wickstrom, Otto W., Capt. (MC) U. S. N.; Patterson, John B., Lt. Comdr. (MC) U. S. N. R.	September-October

To the authors of these articles, a letter of appreciation has been sent by the Surgeon General.

It might be said that the selection of the articles was difficult due to the fact that there were, during the year, so many well-written articles and case reports printed. The titles published here were taken from 117 main articles and case reports published in 1947 in the U. S. NAVAL MEDICAL BULLETIN.



REVISION OF THE HANDBOOK OF THE HOSPITAL CORPS

Since 1914 the Handbook of the Hospital Corps has been the primary reference book for the education and training of hospital corpsmen. It has been published in five editions, the last one appearing in 1939.

Technical specialties in the Hospital Corps have become so diverse that it is not very practicable to place within the confines of one volume all the information that a hospital corpsman should know. Also, most Medical Department activities have rather extensive medical libraries, so that there is less need for so many details as have been included in past editions.

A revision of the present text is now being made. Editors and authors have been assigned the task of preparing a sixth edition of the Handbook, which is expected to be published in 1948. The new edition will contain only some 400 pages and will be pocket-size, with a flexible cover. It will be well illustrated and will serve primarily to acquaint the hospital corpsmen with basic information relative to his duties. In addition, it will point out where he may obtain additional detailed information in standard texts, available on almost every ship and station.

The Handbook will be divided into two main parts, three main sections, and an appendix. Section I will be "First Aid and Minor Surgery," Section II "Hygiene and Sanitation," and Section III "Practical Nursing and Ward Management." The appendix will contain a dosage table, the classification of medicines, a poison and antidote table, standard tests of pharmacy, tables of weights and measures, unofficial formulas, elementary pharmaceutical arithmetic, a discussion of venereal diseases, administration and general clerical procedures, supplies and equipment accountability, a discussion of independent duty, an explanation of the Hospital Corps technical specialties and a "Five-foot Book Shelf" listing the standard books on pharmacy, chemistry, nursing, first aid, special books for technicians, and official manuals. In addition will be standard texts on sciences allied to these fields such as botany, zoology, chemistry, anatomy, and physiology.

The new Handbook is being designed as a ready reference for information needed for all usual Hospital Corps duties. The aim of the editors is to present this information in a brief, concise manner, which it is hoped will stimulate the desire for study and the further reference to additional texts.



NOBEL PRIZE IN MEDICINE FOR 1947

The recipients of the Nobel Prize for Medicine and Physiology were announced 23 October by the Karoline Medical Institute, Stockholm, Sweden, charged with the award. They are Dr. Carl F. Cori and his wife, Dr. Gerty Theresa Cori, of Washington University, St. Louis, and Dr. B. A. Houssay, Chief of the Institute of Experimental Biology and Medicine in Buenos Aires, Argentina.

Dr. and Mrs. Cori received the award for their work on sugar metabolism, particularly the effects of the enzyme which converts starches to glycogen.

Dr. Houssay's work was on the relation of the pituitary controls of sugar metabolism so that the results of all three investigators have a most important bearing on the biochemistry and treatment of diabetes.

The cash value of the prize this year amounted to 175,115 Swedish crowns or \$48,921. The Cori's received one-half or \$24,460.50 and Dr. Houssay an equal amount. Dr. Cori is 51 years of age, Dr. Houssay 60. The former has an 11-year-old son, the latter three sons who are physicians.



APPLICANTS SOUGHT FOR COMMISSIONS IN NAVAL MEDICAL SERVICE CORPS

Applications for commissions in the new Navy Medical Service Corps are desired from qualified Naval Reserve and former temporary officers of the Navy.

Vacancies in the new Navy corps, which was created in the last session of Congress, exist in the pharmacy, optometry and medical allied sciences fields. Ranks of ensign through captain are provided for in the new corps, which is under the supervision of the Bureau of Medicine and Surgery.

Naval Reserve and former temporary officers who held science degrees in psychology, biochemistry, physics, biophysics, bacteriology, pharmacology, radiobiology, serology, virology, chemistry, medical statistics, public health, industrial hygiene, pharmacy, optometry, and sanitary engineering are qualified to apply for appointment to permanent commissioned rank in the Medical Service Corps.

Original appointments are being made in accordance with provisions of the act which permits Reserve and former temporary officers to transfer to the Regular Navy if they served at least 6 months in commissioned status during World War II. Regardless of the date such officers terminated their active duty service, they are eligible for

appointment provided they meet the age, educational, and physical requirements.

For further information applicants should contact their nearest naval officer procurement office or the commandant of their naval district.



FLUIDS AND BLOOD SUBSTITUTES IN TREATMENT OF BURNS

The use of plasma and various mineral ions in the treatment of burns is so generally recognized that every patient receives them. What is not always so well known is that the indications vary with the stage of the burn.

In the first 24 to 48 hours, or shock period, plasma and sodium chloride solution are needed in large amounts in extensive burns. In the second period, which extends from the end of the shock phase to about 10 days, salt solution *must be definitely reduced* or salt retention and edema will follow. Some plasma, or better, a moderate amount of whole blood, is valuable. The administration of sodium ions must be cut down.

In the third or reparative stage the indication is for relief of pain and increased nutrition. This stage is indefinite in length and in extensive burns is always long and difficult. High protein diet, vitamins, whole blood, liver, and iron are of great importance to promote healing in this stage.



THE TREATMENT OF FROSTBITE

The similarity of the tissue damage from extremes of heat and cold has been noticed for some time. Both burns and frostbite are so much alike in pathology that it is not surprising that the treatment has more and more tended to be nearly the same.

It is a widespread popular belief that slow thawing is necessary in the treatment, and rubbing the frozen part or area with snow is commonly employed. In extreme northern latitudes in winter the areas over the cheekbones, the tip of the nose, and ears freeze very quickly. Sometimes in a few seconds an area the size of a dime will appear to blanch over a cheekbone. A handful of snow is usually applied.

It should be mentioned that rubbing the part with snow as is often done is particularly opposed by many, as the sharp snow crystals produce trauma and maceration of the skin. Admiral Byrd, Stefansson, and some other Arctic explorers have questioned the use of snow on frostbite. The Swedish Red Cross does not advocate it and Bellander with extensive experience in Scandinavia favors gradual thawing by means of contrast baths, i. e. warm and cold water used alternately. The warm water is just below body temperature, the cold water about 60°F. Campbell (1932), Bunch (1936), Harkins and Harmon (1937), Rose (1939) and Odelberg (1940) all favor gradual thawing.

There is one thing on which there seems general agreement—*under no conditions must hot water or heat greater than body temperature be used* as it apparently results in serious damage to the intima of the vessels and cell damage generally and increases the necrosis.

Gradual thawing by cold water slowly warmed to nearly body temperature; or else by gentle friction with the hand or dry wool, or other soft dry material, is recommended by most of those with large experience with frostbite.

The local treatment after thawing follows that of a burn, with strict aseptic technique, petrolatum gauze with dry pads over it, mechanics waste over that, and then a pressure bandage. Blisters are not ruptured. Dressings are changed as infrequently as possible. There is the same loss of plasma as is seen in burns and plasma intravenously is indicated if the frozen area is extensive. Whole blood and physiological saline may also be used as adjuncts to the plasma as in burns. Morphine is given if needed for pain. Later treatment includes control of infection by sulfonamides and penicillin, skin grafting, and amputations if necessary. High protein and vitamin diet and every means of promoting well-being and morale are essential.



MEDICAL AND DENTAL OFFICER DEATHS TO BE PUBLISHED IN THE U. S. NAVAL MEDICAL BULLETIN

In response to numerous requests it has been decided to print in the U. S. NAVAL MEDICAL BULLETIN the names of medical and dental officers of the Navy whose deaths have been reported since the previous issue. This feature begins with the present (January–February) number and will continue to appear in subsequent issues. A special page will be used for this purpose, to follow immediately after the Editorial Section.



MEDICAL AND DENTAL OFFICERS

*Whose Deaths Have Been Reported Since
the Last Issue of the Bulletin*

BAISCH, JOHN GUSTAVE, Lieutenant Commander (MC)
U. S. N. (Retired). Died 1 December 1947 at U. S.
Naval Hospital, Long Beach, Calif.

GOULD, MARVIN MEYER, Commander (MC) U. S. N. (Re-
tired). Died 14 November 1947 aboard S. S. *Santa*
Sofia, Barranquilla, Colombia.

HALE, GORDON DYER, Captain (MC) U. S. N. (Retired).
Died 18 October 1947 at Cornwall, Conn.

JACKSON, THOMAS, JR., Lieutenant (MC) U. S. N. (Re-
tired). Died 10 September 1947 at Jefferson Hos-
pital, Philadelphia, Pa.

MAY, ROBERT OSCAR, Lieutenant, junior grade (MC)
U. S. N. R. (Active). Died 16 September 1947 at
Massa Marittima, Italy.

MEARS, JOHN BOWDOIN, Captain (MC) U. S. N. (Retired).
Died 16 November 1947 at U. S. Naval Hospital, Ports-
mouth, Va.

CLINICAL NOTES



TULAREMIA

Report of a Case¹

HENRY R. COOPER
Lieutenant (MC) U. S. N.

A 30-year-old, colored male, veteran of the European theater, was admitted to the General Medical Service at the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., on 1 December 1946. The admission history stated that the patient had been ill for approximately 1 month with severe malaise and high daily fever. He denied any concurrent complaints other than anorexia and a slight nonproductive cough. The family and past history were not remarkable. The admission history further stated that he worked in a fish market. The physical examination revealed no evidence of weight loss; however, the patient was noted to be markedly weak and feverish, but without pain. The oral temperature was 103.4° F. and the blood pressure 120/68. There was moderate diffuse pharyngeal injection. Slight cervical adenopathy was found, and diffuse, medium-sized sonorous inspiratory and expiratory râles were heard. There was no evidence of pulmonary consolidation. A Grade 1 systolic aortic murmur was noted. The abdomen was negative, and the reflexes were hypoactive bilaterally.

When examined the following day on the ward, the patient was delirious, and it was evident that no reliance could be placed on his history. The physical examination at that time differed from the admission examination only in that it revealed a whitish, gingival membrane, a short pulmonic systolic murmur, no aortic murmur, and no generalized adenopathy. It was felt that the patient might have an atypical pneumonia, but he appeared so ill that an acid-fast infection or even an endocarditis was considered. A chest x-ray at this time revealed faint clouding at the left base with blunting of the left costophrenic angle. The left lung root showed marked increased density. A complete blood count revealed 3,100,000 red blood cells and 16,600 white blood cells, with 67 granulocytes, 22 lymphocytes, and 11 monocytes. A repeat count the same day was reported as 11,350 white blood cells with essentially the same differential. Intravenous fluids and penicillin were begun.

On the third hospital day the patient appeared to be more toxic, and the rectal temperature was 106° F. He was vomiting all fluids taken by mouth. Sulfadiazine therapy was begun.

By the evening of the fourth hospital day it was apparent that the patient's disease was not sensitive to penicillin or sulfadiazine. Fortunately, by placing

¹ From the General Medical Service, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., under the supervision of Commander H. L. Jones (MC) U. S. N.

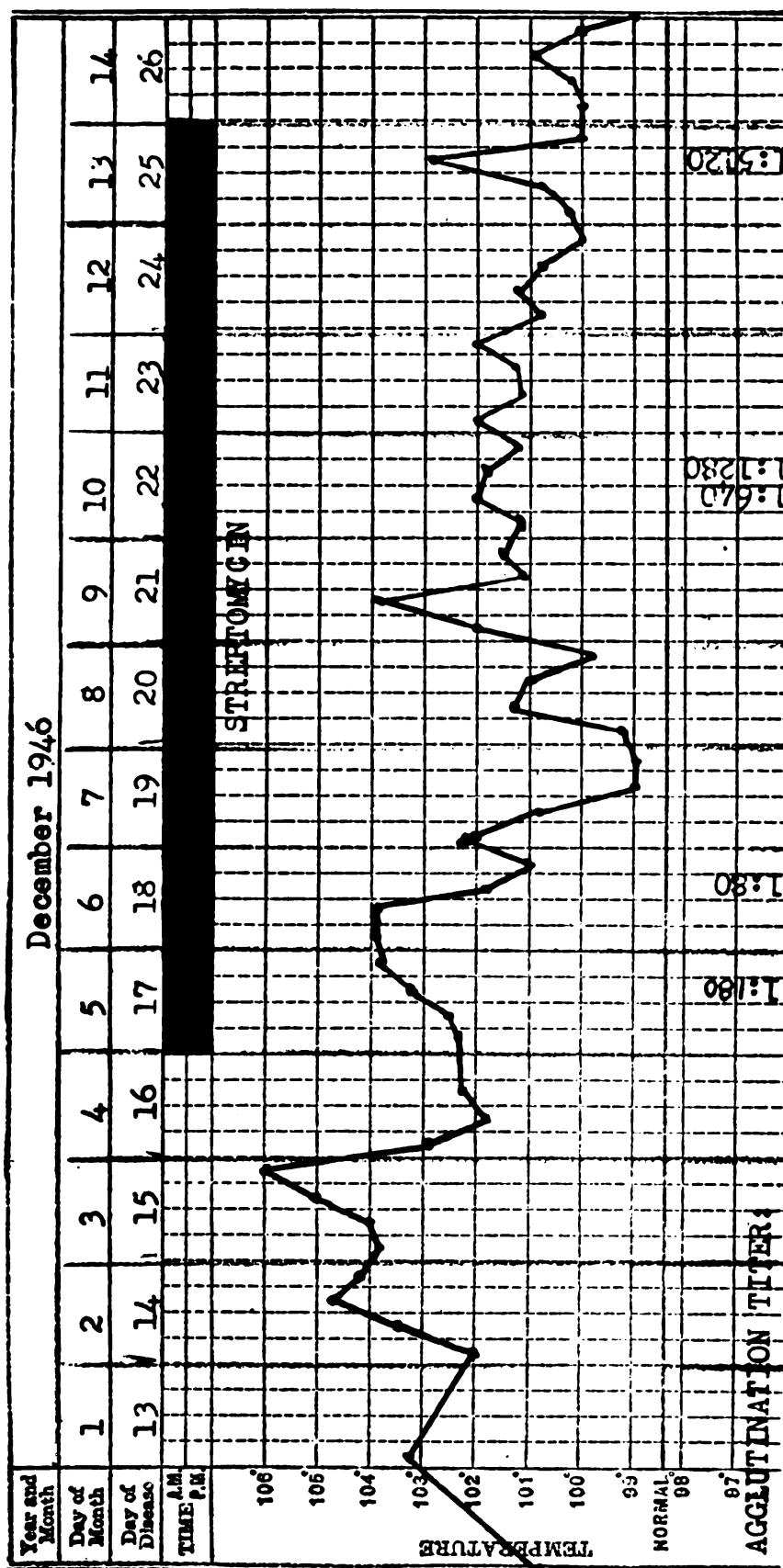


FIGURE 1.—Oral temperature and agglutination chart of the first 14 hospital days (thirteenth to twenty-sixth day of the patient's illness). The temperature did not rise above 99.5° F. on days subsequent to those charted.

the patient on the serious list, his relatives visited the hospital, and a very revealing history was thus obtained. The patient worked in a poultry and fish market which also sold wild rabbits when the latter were in season. In this locality the rabbit season begins on 15 November. According to his brother's statement, the patient became ill on 19 November but continued to work until 23 November. From the onset of the disease on 19 November until admission on 1 December, the patient was known to have run a high, continuous fever. With this history, fever, blood counts, x-ray findings of the chest, and lack of response to penicillin and sulfonamide therapy, a tentative diagnosis of tularemia of the typhoidal and pneumonic type was made. Careful examination failed to reveal any primary lesion, but it was felt that there was a small left epitrochlear node and one enlarged lymph node deep in the left axilla.

The next morning, on the fifth hospital day, streptomycin therapy (0.5 gram every 3 hours) was begun. At this time, the patient was in a critical condition. The main complicating factor was a gross abdominal distention which caused marked respiratory embarrassment. A repeat chest x-ray was again consistent with early pneumonitis with markedly exaggerated hilar shadows.

On the sixth hospital day an agglutination for tularemia was reported as being positive in a titer of 1:80. This was considered fair confirmation of the diagnosis. Forty-eight hours after beginning streptomycin the temperature had dropped to approximately normal levels, but despite this temperature drop the patient's mental status and distention were not improved. The dyspnea continued, with respiratory rate of 40 per minute. The urine revealed occasional granular casts, albumin, bile, and urobilinogen in 1:320 dilution. Several sputum cultures and mouse inoculations, both before and after beginning streptomycin, were made for *Bacterium tularense*, but no organisms were ever recovered. (The sputum was very scanty, and little hope of obtaining a positive culture was entertained. The mouse inoculations were done through the courtesy of Dr. Larson at the National Institute of Health.)

On the seventh hospital day the patient vomited two or three times, and the abdomen was silent except for infrequent, high-pitched tinkles. Prostigmine with a rectal tube, turpentine stupes, and a Wangenstein apparatus with a Miller-Abbott tube were directed against the distention. The patient apparently had a paralytic ileus. The impression of ileus was substantiated by a flat plate of the abdomen which also showed marked elevation of the diaphragm. Streptomycin dosage was decreased to 2 grams per day, and the patient was maintained in an oxygen tent. Carphology was a prominent sign.

On the eighth hospital day the patient's temperature again rose to 102° F. rectally, respiration 40, pulse 128. He also became incontinent. However, the Wangenstein was functioning properly, and continued efforts kept the patient in electrolyte balance. Blood transfusions were begun (1,500 cc. in 24 hours) to combat the anemia, as the red blood count had dropped below 3,000,000 cells. The patient evidently had a hemolytic anemia.

On the ninth hospital day râles were present in both bases, and an electrocardiogram showed myocardial damage. The distention was markedly decreased. At this time the agglutination titer had risen to 1:1280.

On the tenth hospital day the patient's condition remained about the same, but as the albumin had dropped to 3.3 and the globulin to 2.7, steps were taken to maintain the total proteins. A flat plate of the abdomen showed the tip of the Miller-Abbott tube in the terminal ileum, and there was little distention except in the colon.

By the twelfth day the patient was lucid, the abdomen soft, and general improvement was noted. The Wangenstein was discontinued. The electrocardiogram, 6 chest leads, still showed myocardial damage.

On the thirteenth day the patient was put on clear liquids, and the oxygen tent was discontinued.

Streptomycin was discontinued altogether on the fourteenth hospital day, the patient having received a total of 22 grams in 9 days.

On the seventeenth day, a pleural friction rub was noted over the left base posteriorly, but the patient's temperature did not rise above 99° F. An electrocardiogram revealed marked changes toward a normal tracing. The patient continued to improve and was discharged on 4 January 1947 with a normal sedimentation rate, electrocardiogram, and chest x-ray, and an agglutination titer of 1:5120.

The patient was seen again on 24 January 1947 and was in excellent health. His agglutination titer had dropped to 1:640. On 2 May 1947 the titer was 1:160.

DISCUSSION

Eighty percent of tularemia cases are of the ulceroglandular type, and only 6.4 percent are of the typhoidal type. However, 57 percent of the typhoidal type also have tularemic pneumonia (12). Prior to streptomycin therapy, the over-all tularemia mortality was 6.9 percent, but in the typhoidal type 46.7 percent died (6). There is no racial variance in susceptibility to contracting the disease, but negroes manifest less resistance, particularly when they have the pneumonic type (13). From a clinical point of view, Foshay (5) states that prior to streptomycin the average case of tularemia had 31 days of fever, 31 days in bed, a duration of symptoms of about 4 months, bubos about 3½ months, and a primary lesion healing time of about 39 days. When judging the effects of streptomycin, the above statistics and facts are kept in mind. This antibiotic has been found to be bacteriostatic and bacteriocidal, both in vivo and in vitro, against *Bacterium tularensis*. It seems fairly certain that if streptomycin therapy is begun early in the disease, there is great subjective and objective improvement, and the course of the disease is materially shortened. In some instances the improvement following streptomycin is most dramatic. There are several cases reported, however, when the drug was started sometime after the waning of the acute symptoms, and there was little, if any, effect on the subsequent course of the disease. In the acute cases the drug appears to take effect in from 12 to 48 hours, and it does not appear to interfere with agglutination titers. In most of the cases reported (prior to February 1947) the total dosage used varied between 2,000,000 and 6,000,000 units, and few cases received medication longer than 1 week. The dosage in this case was about four times more than that used in most of the reported cases.

In general, it may be said that this patient had 26 days of fever, 31 days in bed, 30 days' duration of symptoms, and 6 weeks' disability. This course is considerably shorter than the average case as described by Foshay, and taking into consideration the severity of the patient's illness, it is a marked improvement over the usual course. It is felt

that this patient would undoubtedly have died without hospitalization and streptomycin therapy; but certainly factors other than streptomycin entered into his recovery, such as parenteral fluids and the use of the Wangensteen and other measures to combat the paralytic ileus.

This case is reported to stress the severity of typhoidal and pneumonic tularemia and also to point out that in some cases the response to streptomycin may not be dramatic or clear-cut. Prior to the appearance of positive agglutination titers in cases of typhoidal and pneumonic tularemia, the laboratory verification of the clinical impression is often difficult. In view of this difficulty, Hunt has suggested a therapeutic trial of 1 to 2 grams of streptomycin for 2 days. The antibiotic can then be continued or discontinued according to the clinical response of the patient during this period. This appears to be a practical suggestion. However, it should be borne in mind that as in this case the response to streptomycin may not be obvious immediately. Hence, it may be well to continue the therapeutic test for longer than 2 days.

SUMMARY

A severe case of tularemia of the typhoidal and pneumonic type has been presented to stress the fact that in such cases the response to adequate streptomycin therapy may not be immediate or dramatic.

REFERENCES

1. ABEL, O., JR.: Use of streptomycin in tularemia. *J. Missouri M. A.* **43**: 167-169, Mar. 1946.
2. ATWELL, R. J., and SMITH, D. T.: Primary tularemia pneumonia treated with streptomycin; report of two cases. *South. M. J.* **38**: 858-860, Nov. 1946.
3. BIHSS, F. E., and BERLAND, H. I.: Roentgenological manifestations of pleuropulmonary involvements in tularemia. (*Radiology* **41**: 431-437, Nov. 1943.
4. COHEN, R. B., and LASSEY, R.: Primary tularemia pneumonia treated with streptomycin. *J. A. M. A.* **131**: 1126-1127, Aug. 3, 1946.
5. FOSHAY, L., and PASTERNAK, A. B.: Streptomycin treatment of tularemia. *J. A. M. A.* **130**: 393-398, Feb. 16, 1946.
6. FRANCIS, E.: Tularemia. In TICE, F.: *Practice of Medicine*, vol. 3: W. F. Prior Co., Inc., Hagerstown, Md., 1941. pp. 663-678.
7. FRANCIS, E.: Personal communication.
8. GORDON, A. M.: Streptomycin in tularemia. *J. A. M. A.* **132**: 21-22, Sept. 7, 1946.
9. HUNT, J. S.: Pleuropulmonary tularemia; observations on 12 cases treated with streptomycin. *Ann. Int. Med.* **26**: 263-276, Feb. 1947.
10. HOWE, C.; CORIELL, L. L.; BOOKWALTER, H. L.; and ELLINGSON, H. V.: Streptomycin in tularemia. *J. A. M. A.* **132**: 195-200, Sept. 28, 1946.
11. KURSBAN, N. J., and FOSHAY, L.: Tularemia acquired from the pheasant. *J. A. M. A.* **131**: 1493-1494, Aug. 31, 1946.
12. STUART, B. M., and PULLEN, R. L.: Tularemia pneumonia; review of American literature and report of 15 additional cases. *Am. J. M. Sc.* **210**: 223-236, Aug. 1945.

13. PULLEN, R. I., and STUART, B. M.: Tularemia; analysis of 225 cases. J. A. M. A. 129: 495-500, Oct. 13, 1945.
14. SIMPSON, W. M.: Tularemia: History, Pathology, Diagnosis and Treatment. Paul B. Hoeber, Inc., New York, N. Y., 1929.



BRONCHIOGENIC CYSTS OF THE MEDIASTINUM

Report of a Case

ROBERT B. BROWN
Commander (MC) U. S. N.

Bronchiogenic cysts are also known as bronchial cysts, ciliated epithelial cysts, ciliated columnar cysts, and reduplication cysts of the respiratory tract. Classified as reduplication cysts of the respiratory tract they are representative of one type of the larger group of so-called reduplication cysts which include, in addition, esophageal, gastric, and gastro-enteric cysts. These cysts may contain any or all of the tissues normally present in the structures for which they are named. They are probably the result of developmental anomalies, and various theories are offered in explanation. A discussion of these theories is beyond the scope of this short presentation.

CASE REPORT

The patient, a white male, age 40, was admitted to the hospital on 16 January 1947. He presented no complaints. On a routine roentgenological examination for discharge from the service a mediastinal mass had been found. He was sent from the separation center for diagnosis and treatment.

Systemic review was negative. Past and family histories were irrelevant.

Physical examination revealed a healthy-appearing, stockily-built male. Temperature, pulse, and respirations were within normal limits.

Blood pressure was 138/90 on the right and 138/92 on the left. The remainder of the physical examination was negative.

Routine laboratory studies including complete blood count, urine examination, sedimentation rate, and Kahn test were negative.

Fluoroscopic examination of the chest revealed an oval, poorly defined mass in the posterior mediastinum, which displaced the barium-filled, middle third of the esophagus to the left, slightly compressing the lumen. The mass did not pulsate. Films confirmed the fluoroscopic findings, and showed a fairly well circumscribed, homogenous mass, approximately 8 cm. in the vertical diameter and 6.5 cm. in the transverse diameter, located between the fifth and tenth thoracic vertebral levels (figs. 1 and 2). Examination in the right and left oblique views failed to show roentgen evidence of erosion of the anterior portions of the thoracic vertebrae adjacent to the mediastinal mass.

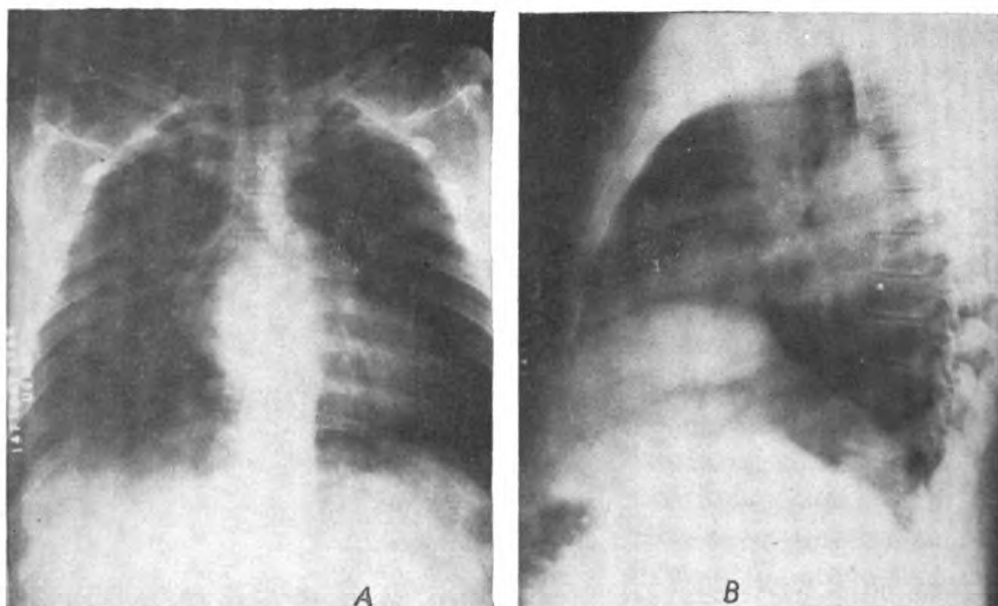


FIGURE 1.—(A) and (B) Films taken by the Bucky technique. The mass in the posterior mediastinum is demonstrated in both the anteroposterior and lateral projections.

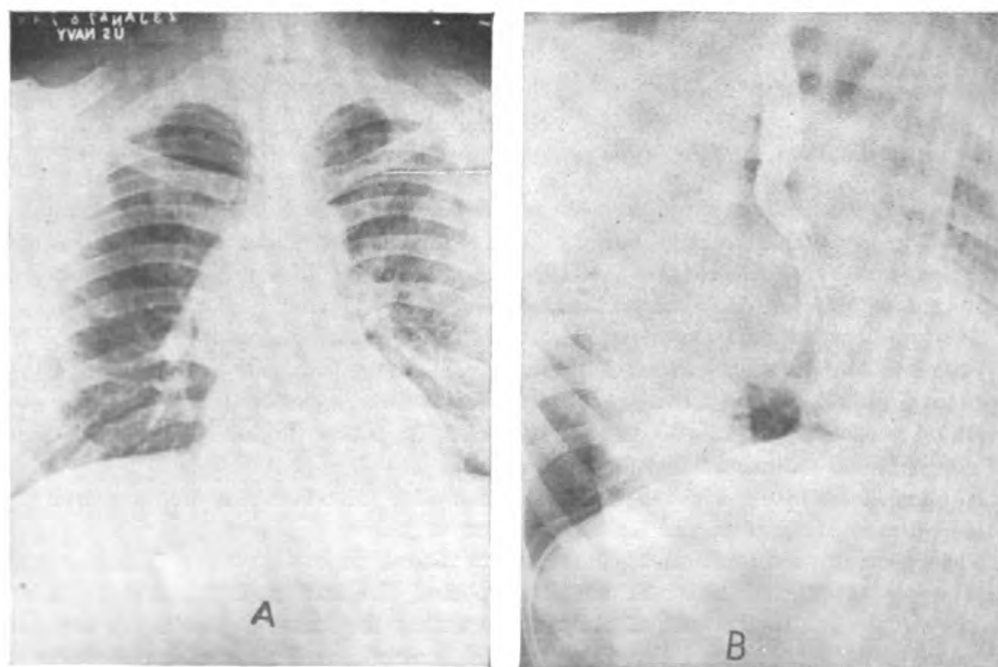


FIGURE 2.—(A) and (B) Films taken in the postero-anterior and right oblique projections. The barium in the esophagus has been outlined to bring out the deviation and slight compression of this structure by the mediastinal mass.

Preoperative diagnostic opinion was divided between a neurogenic tumor and one of the group of so-called reduplication cysts.

Operation was performed on 26 February 1947 under intratracheal cyclopropane anesthesia. A posterolateral transpleural approach was made through the bed of the resected sixth rib on the right. Adhesions between the visceral and parietal pleura overlying the lung were separated without much difficulty to expose the tumor. It was obviously cystic in character and of the size described by the roentgenologist. It presented from the posterior mediastinum directly behind the hilus of the lung. The azygos vein coursed over the superior pole, and the inferior pole extended downward beneath the pulmonary ligament.

The mediastinal pleura over the cyst was incised. The azygos vein was retracted superiorly, and the lung anteriorly and medially. A rather easily estab-

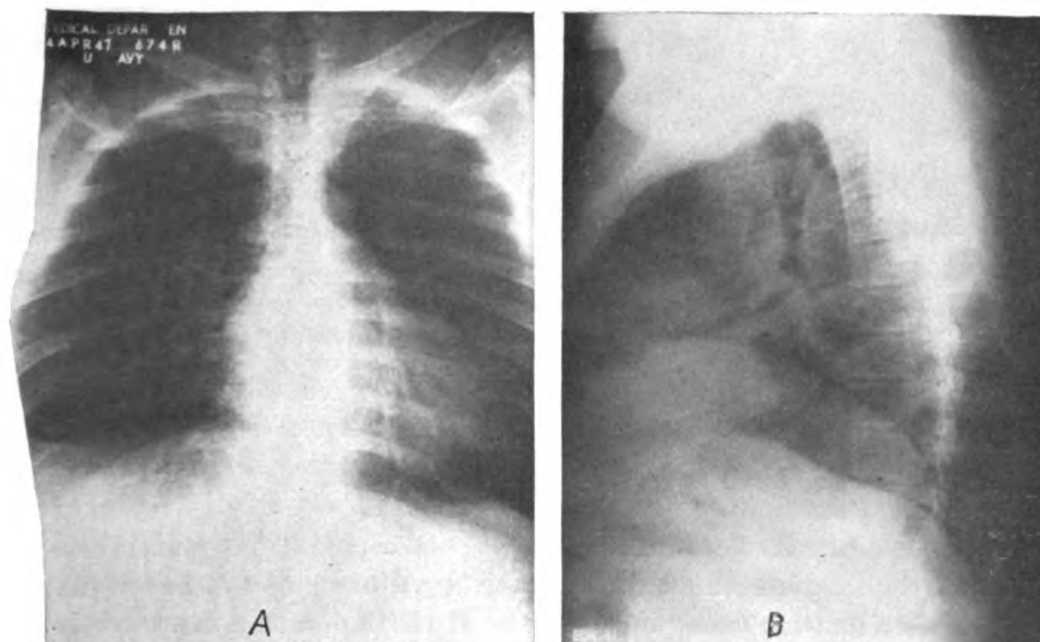


FIGURE 3.—(A) and (B) Postoperative films taken by the Bucky technique for comparison with figure 1. The mediastinal mass is no longer demonstrable in the lateral view, but clearing in the postero-anterior projection is not yet complete.

lished line of cleavage was followed to free the cyst from surrounding mediastinal structures with the exception of the right main stem bronchus. Here there was an area of dense adherence requiring sharp dissection; however, no communication with the bronchus was demonstrable. The cyst was evacuated inadvertently during its removal and several ounces of viscid, whitish fluid were obtained.

Catheter drainage of the right pleural space was established through the ninth interspace in the posterior axillary line. The lung was reexpanded and the wound was closed in layers with buried catgut. Cotton was used in the skin.

Convalescence was entirely uneventful. The water-seal drain was removed in 48 hours at which time the patient became ambulatory, and continued so without complaint.

Postoperative roentgenograms of the chest which show some pleural effusion on the right and a reversion of mediastinal contours toward the normal are reproduced in figure 3.

The cyst itself was thin walled and not loculated. The milky, fluid content was acid in reaction. On culture it showed no growth. The lining epithelium was predominantly ciliated columnar although this was flattened in some areas. Connective tissue, mucous type glands, smooth muscle, and cartilage were all found in the cyst wall (figs. 4 and 5). A pathological diagnosis of bronchiogenic cyst was made.



FIGURE 4.—This section is taken through an infolding of the cyst wall which is lined with ciliated columnar epithelium (A). Smooth muscle bundles (B) cut in cross section are seen in the wall on both sides of the fold.

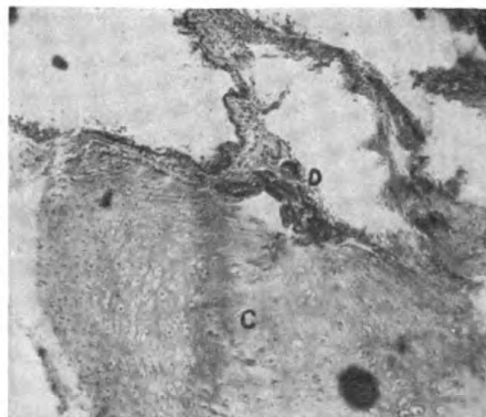


FIGURE 5.—This section shows two other elements of the cyst wall, cartilage (C) and glands (D).

DISCUSSION

Until recently the total number of reported cases of bronchiogenic cysts of the mediastinum was a rather small one. Still smaller was the number in which surgical removal of the lesion had been accomplished. Heuer and Andrus (1) in 1940, in a masterful review of the surgery of mediastinal tumors, collected 25 cases from the literature and added 1 case of their own. In 1945 Laipply (2) found 34 cases of bronchiogenic cysts reported to that date and added 1 case. Of these 35 cases only 6 had come to surgery and in only 4 cases had the cyst been completely excised.

In 1946 Col. Brian Blades (3), drawing from the vast experience of the Army thoracic centers, reported 109 operations for mediastinal tumors of which 23 were bronchiogenic cysts successfully removed. Although Blades still concedes that these lesions are relatively rare, it is with some humility that we offer our 1 case to a suddenly surfeited market. However, it does typify many of the points in diagnosis and treatment of these lesions.

Robbins (4) has discussed the roentgenologic appearance of bronchiogenic cysts. This he describes as, "A smooth, round or ovoid mass arising from the mediastinum without evidence of bone erosion or calcification within the wall." Demonstration of tracheal attachment by fluoroscopic examination is listed as an additional diagnostic point.

In the differential diagnosis between bronchiogenic cysts and primary nerve tumors Blades (3) makes a point of the more posterior position of the nerve tumors in the lateral projection. Perhaps we should have profited by this suggestion of Blades in establishing a preoperative diagnosis in this case.

Bronchiogenic cysts may be located in the mediastinum anywhere along the tracheobronchial tree or even on the diaphragm (3) or in the lung. The situation of the cyst near the bifurcation of the trachea in our patient is the usual one. Adherence or attachment to the trachea or bronchus without communication is typical. The viscid or mucoid fluid content is the common finding. The histological demonstration in the cyst wall of all the tissues normally found in the trachea establishes the diagnosis.

Nothing has been said of clinical signs and symptoms in diagnosis. When present they are due to pressure on adjacent structures or to infection. Pain, cough cyanosis, dysphagia, and fever are among those listed. Our patient had no complaints referable to the bronchiogenic cyst. The diagnosis was purely a radiological one as in 21 of the 23 Army patients (3). In the civilian groups reported upon (1) (2) a different situation is encountered. Chest roentgenograms were not routine and compulsory. The majority of cysts were diagnosed either because attention had been directed to them by presenting signs or symptoms or, when asymptomatic, were discovered as incidental findings at the autopsy table. When signs and symptoms are present they usually develop in the infant during the first months of life.

Roentgenographic study of the chest as an integral part of periodic and routine physical examinations is reaching increasing numbers of our populace. Intrathoracic lesions will be discovered more frequently in the quiescent stage.

The question may be raised and justifiably, as to the advisability of operating upon these benign cysts if they are asymptomatic. The most important reason for doing so is that one can never, with absolute certainty, establish the diagnosis before removal of the lesion. Tumors with a much greater threat to life and which demand excision in the asymptomatic stage, if a cure is to be expected, may be passed over when watchful waiting is practiced. Bronchiogenic cysts themselves present the threat of growth or infection with accompanying symptoms and increased difficulty of removal. The possibility of malignant degeneration, so far as we know, has not been established.

SUMMARY

1. A case of bronchiogenic cyst of the mediastinum is reported.
2. The diagnostic features including typical radiographic and histologic findings are presented.

3. Treatment by surgical extirpation is recommended, even in the absence of symptoms.

REFERENCES

1. HEUER, G. J., and ANDRUS W. DeW.: Surgery of mediastinal tumors. *Am. J. Surg.* 50: 146-224, Oct. 1940.
2. LAIPPLY, T. C.: Cysts and cystic tumors of mediastinum. *Arch. Path.* 39: 153-161, Mar. 1945.
3. BLADES, B.: Mediastinal tumors; report of cases treated at Army thoracic surgery centers in United States. *Am. Surg.* 123: 749-765, May 1946.
4. ROBBINS, L. L.: Roentgenologic appearance of "bronchiogenic" cysts. *Am. J. Roentgenol.* 50: 321-333, Sept. 1943.



EPIDERMOLYSIS BULLOSA HEREDITARIA

PAUL H. MORTON

Commander (MC) U. S. N.

and

THOMAS C. DEAS

Lieutenant, junior grade (MC) U. S. N.

Because of the tremendous expansion of the armed forces during the recent war and the unprecedented number of persons coming under medical surveillance for the first time, it was to be expected that many of the so-called "rare" diseases would be more frequently encountered. Epidermolysis bullosa hereditaria is such a disease. It is, therefore, felt that this case, recently observed at a naval hospital located at a Marine Corps base, is worthy of report, especially in view of the hereditary background, so typical of this disorder, which is so clearly demonstrated.

CASE REPORT

An 18-year-old white Marine recruit was admitted to the hospital on 8 July 1946 complaining of recurrent blisters on the soles of his feet, ankles, trunk, and both shoulders. He had just arrived at the recruit depot and had commenced his training only 3 days before. Upon questioning he stated that he had suffered with them since birth, and that other members of his family had the same disease, which had never responded to any form of treatment.

He had little or no trouble during the cold season, but the disease appeared during hot weather whenever any surface of the body was subjected to trauma or irritation. No evidence of the disorder was present at the time of enlistment, but after his arrival here, due to the marching and drilling with a rifle, and the warm climate, typical bullous lesions soon made their appearance on the soles of his feet and around his ankles, due to friction of shoes and stockings, on the

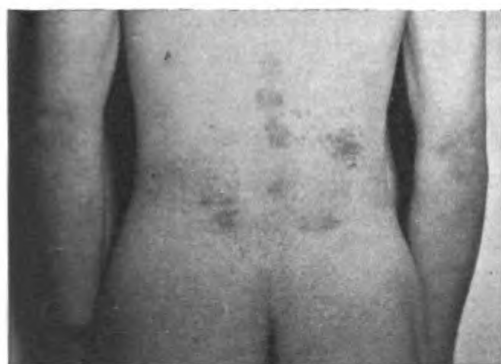


FIGURE 1.—Showing bullous lesions of epidermolysis bullosa.



FIGURE 2.

shoulders where he rested his rifle, and around his waist, due to irritation of belt and clothing.

The physical examination was essentially negative, except for the presence of the characteristic bullous lesions (figs. 1 and 2) upon both shoulders, around the waistline and upon the ankles and soles of both feet. The bullae were non-erythematous, unilocular, moderately tender, and filled with clear, yellowish, serous fluid. In size they varied from about 2 to 5 millimeters, being most extensive on top of the left shoulder, where his gun had usually rested. No gross abnormalities of the hair, teeth, or nails were noted. Laboratory studies, including blood counts, urinalyses, and Kahn test, were all within normal limits, and x-ray of the chest was negative. The patient declined to permit a biopsy of one of the lesions for histological study. Under a regime of bed-rest and local protective treatment, the bullous lesions gradually disappeared, leaving areas of brownish pigment. He was eventually discharged as physically unfit for military service.

Of particular interest in this case was the information which was obtained concerning the familial and hereditary nature of the disease, which had been transmitted from the patient's maternal grandmother to certain of her descendants (fig. 3). She was the only one afflicted of a family of 8 children. Then

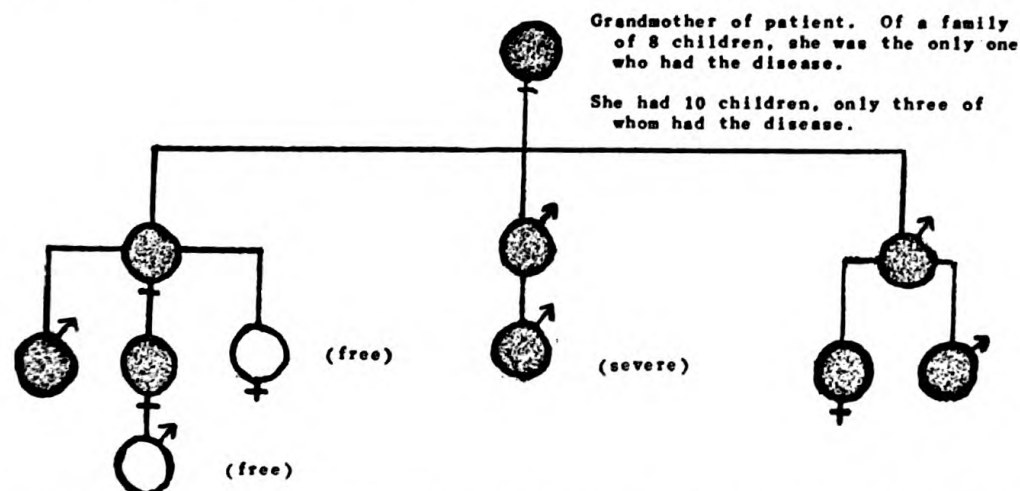


FIGURE 3.—Family tree illustrating the hereditary characteristics of a case of epidermolysis bullosa hereditaria.

she had 10 children of her own, of whom only 2 males and 1 female (the mother of our patient) had the disorder. One of these two males (uncles of our patient) is married and has two children, both of whom have the disease. The other uncle, who is severely afflicted, is married, but has no children. Our patient's older married sister also suffers from the disease in a relatively severe form, but she has 1 child, who, thus far, is entirely free.

Our patient's mother, now in her fifties, is asymptomatic. She has no visible signs of the disease now except scars. About 4 years ago, during a period of hospitalization, following a surgical operation, she had a recurrence of the lesions on her back, due to lying on a rubber sheet. But even now, prolonged walking on hot pavements will still cause a recurrence of the lesions on the soles of her feet.

It is to be noted that children born to members of the family who show no evidence of the disease are invariably free from it themselves, thus it appears to be inherited as a dominant characteristic.

DISCUSSION

The etiology of the disease is not definitely known, but many theories have been advanced. Winer and Orman (1) suggested that a defect of the vascular mechanism is the underlying, basic, pathological feature. The chief histopathologic changes observed in skin biopsies taken from both affected and nonaffected areas are a deficiency or complete absence of elastic tissue and separation of the epidermis from the underlying corium (2). In affected areas the blood vessels are dilated, with perivascular infiltration of leukocytes. This is probably due to the well-recognized effect of histamine or *H*-substance of Lewis, liberated by tissue damage, causing local vasodilatation and increased capillary permeability, with transudation of serum into the perivascular spaces (3). The congenital absence or paucity of yellow elastic fibers in the skin increases the probability of the development of bullae and vesicles in response to relatively minor trauma or irritation.

Heredity seems to be an important factor, and consanguinity has a tendency to predispose. There is no racial susceptibility, but males are more frequently affected than females.

Two main types of the disease are described (1) (5) (7) a simple or benign, and a dystrophic type. The simple or benign variety is characterized by the development of vesicles and bullae, chiefly on the extensor surfaces and other areas exposed to trauma. Occasionally the mucous membranes are involved. The lesions are usually few and do not lead to atrophy or scarring. However, pigmentation may remain. In the dystrophic type blisters occur which have a tendency to become hemorrhagic. Atrophic scars remain, which, if they occur on the buccal mucosa, may lead to leukoplakia and carcinoma. Changes in the other ectodermal structures, such as hair, teeth, and nails, are more apt to occur in this form of the disease.

The dystrophic variety has been further subdivided into two types based upon hereditary transmission, the dominant, which shows moderate involvement of the ectodermal structures without seriously affecting the health of the individual, and the recessive, in which severe abnormalities of the teeth, hair, or nails may be present. An "acquired" form has been mentioned by some authors (4) (5) while one writer (6) describes a so-called "lethal" form (*bullosa hereditaria letalis*) occurring in infants, all of whom died at an early age. The case here cited belongs to the simple type.

Clinical and pathological studies have revealed little of diagnostic significance in this disease. An increased blood cholesterol has been reported (7), and so has an accelerated basal metabolic rate (8). Nikolsky's sign (removal of outer skin layer by slight trauma) is not consistently positive. Porphyria has also been reported. (9).

The disease generally runs a chronic course with some tendency toward abeyance or subsidence as middle age is approached. However, the onset of puberty has occasionally resulted in complete subsidence of symptoms. There are seasonal fluctuations with exacerbations accompanying warm weather. Moisture and trauma aggravate the condition.

Treatment is completely prophylactic and symptomatic. In military or naval personnel, severe dermatophytosis of the feet, with blisters, might easily be confused with epidermolysis bullosa, particularly if only the lower extremities are involved. The absence of pruritus, and failure to find the etiological mycotic agent upon microscopic study of skin-scrapings would aid in the differential diagnosis. Bul-
lous erythema multiforme, impetigo contagiosa bullosa and pemphigus vulgaris are other entities which should be considered in dealing with atypical forms of the disease. A hereditary history, and typical biopsy finding would be of greatest aid in establishing the diagnosis.

SUMMARY

A case of the simple type of epidermolysis bullosa hereditaria, with a family history involving three generations with eight other cases, has been presented.

Treatment is purely symptomatic and prophylactic.

In military and naval personnel particularly, epidermophytosis is most likely to be confused with epidermolysis bullosa. Victims of this disease are obviously unfit for military service.

REFERENCES

1. WINER, M. N., and ORMAN, J. M.: Epidermolysis bullosa; a suggestion as to possible causation. *Arch. Dermat. & Syph.* 52: 317-321, Nov.-Dec. 1945.

2. ENGMAN, M. F., and MOOK, W. H.: Study of some cases of epidermolysis bullosa, with remarks upon congenital absence of elastic tissue. *J. Cut. Dis.* **24**: 55, 1906. (Cited by Winer.)
3. LEWIS, T.: *The Blood Vessels of the Human Skin and Their Responses.* Shaw & Sons, Ltd., London, 1927.
4. WISE, F., and LAUTMAN, M. F.: Epidermolysis bullosa beginning in adult life; the acquired form of the disease, with the report of a case and review of the literature. *J. Cut. Dis.* **33**: 44, June 1915. (Cited by Winer, et al.)
5. WAISMAN, M.: Recurrent bullous eruptions of feet and hands (Weber-Cockayne); localized epidermolysis bullosa. *J. A. M. A.* **124**: 1247-1250, April 29, 1944.
6. HERLITZ, J.: Kongenitaler, nicht syphilitischer Pemphigus. Eine Übersicht nebst Beschreibung einer neuen Krankheitsform (Epidermolysis bullosa hereditaria letalis). *Acta. paedlt.* **17**: 315-371, 1935. Cited by BLACK, R. A.; WILHELM, E.; GILBERT, C. S.; and WHITE, C. J.: Epidermolysis bullosa in newborn. *J. A. M. A.* **129**: 734-736, Nov. 10, 1945.
7. MORTIMER, E. Z.: Epidermolysis bullosa hereditaria; report of 2 cases. *J. Pediat.* **28**: 613-617, May 1946.
8. LUDY, J. B., et al: *M. Clin. North America* Feb. 1941. (Cited by Mortimer.)
9. KIERLAND, R. R., and HARRISON, M. W.: Epidermolysis bullosa with unusual distribution and elevated urinary porphyrins; report of case. *Proc. Staff Meet. Mayo Clin.* **15**: 313-316, May 15, 1940. (Cited by Mortimer.)



SURGICAL REMOVAL OF AN ODONTOMA AND IMPACTED ANTERIOR TEETH

Report of a Case

RALPH W. TAYLOR

Captain (DC) U. S. N.

and

RAYMOND F. HUEBSCH

Commander (DC) U. S. N.

History.—The patient, a white male, aged 20, presented, upon a routine radiographic examination, deciduous mandibular right lateral incisor and cuspid teeth. This examination revealed a compound composite odontoma and two permanent impacted teeth. He was admitted to the hospital for their removal.

Clinical findings.—Oral clinical examination revealed a normal dentition, except for the presence of the deciduous mandibular teeth, which were in their normal position in the mandibular arch. All lower anterior teeth gave a positive response to vitality tests. No abnormal prominences could be palpated on the labial or lingual surfaces of the mandible.

Radiographic findings.—The roots of the deciduous mandibular right lateral incisor and cuspid teeth were partially resorbed. Immediately inferior to the

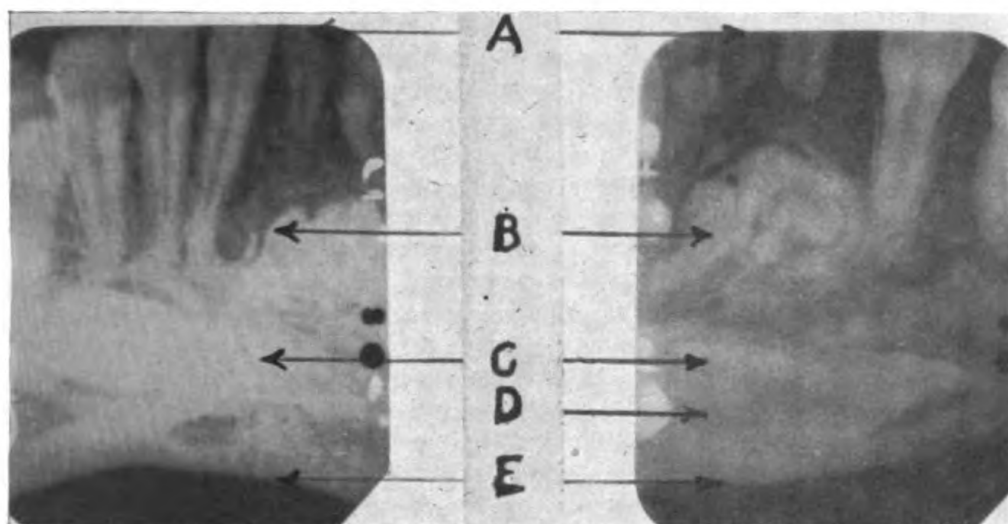


FIGURE 1.—Preoperative dental radiographs.—A. Deciduous teeth. B. Compound composite odontoma. C. Cuspid tooth. D. Lateral incisor tooth. E. Inferior border of mandible.

deciduous roots and mesial to the right first bicuspid root, was located a compound composite odontoma, measuring approximately $1\frac{1}{2}$ centimeters in diameter. Just below the odontoma and slightly above the inferior border of the mandible, were two impacted teeth (cuspid and lateral incisor) which were lying in a horizontal position. The incisal edge of the lateral incisor tooth was facing to the right and the tip of the cuspid crown faced to the left. Their roots were superimposed upon each other. The cuspid tooth appeared to be located labially to the lateral incisor tooth (fig. 1).

Premedication.—20,000 units of penicillin, intramuscularly every 3 hours, was started 24 hours before the operation as a prophylactic measure.

Nembutal grains $1\frac{1}{2}$ the night before followed by $1\frac{1}{2}$ grains 1 hour before the operation.

Morphine sulfate grain $\frac{1}{4}$ with atropine sulfate grain $\frac{1}{150}$ on call.

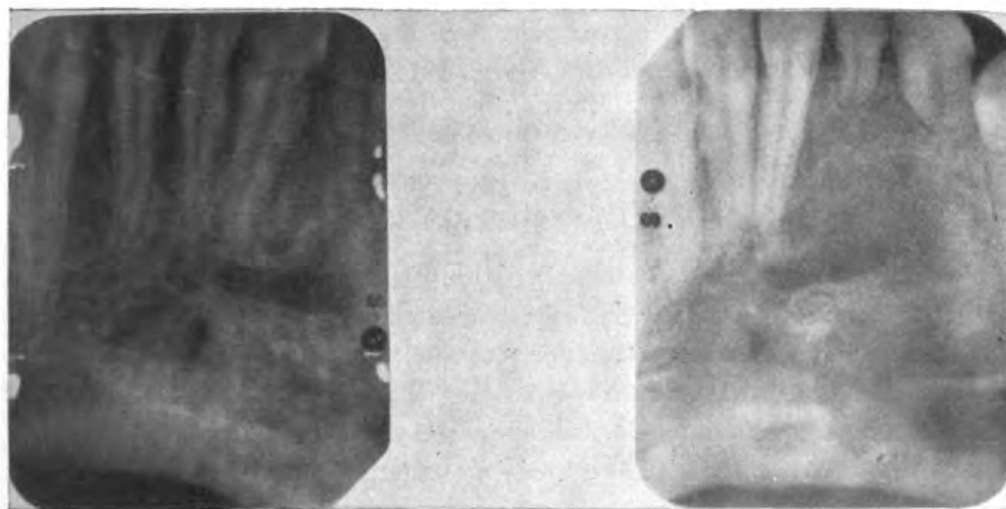


FIGURE 2.—Postoperative dental radiographs.

Surgical procedure.—Bilateral mandibular blocks of procaine hydrochloride were given with a generous infiltration in the labial soft tissues of the mandible. A semilunar incision was made from the mucobuccal fold of the right first bicuspid tooth to within 4 millimeters of the gingival crest in the midline to form a continuous curve to the respective region of the left bicuspid tooth. The incision was made just mesial to the mental foramina. The mucoperiosteum was elevated and retracted labially to the inferior border of the mandible, exposing the entire labial plate. Using surgical burs, numerous holes were bored along the labial plate in the region of the odontoma and impacted teeth. The bone was removed with rongeur forceps and chisels. The odontoma was enucleated. It consisted of 22 denticles measuring from the size of a grain of rice to a rudimentary cuspid 1 centimeter in length. The impacted cuspid was removed with little difficulty. The impacted incisor was embedded lingually and was separated from the cuspid by a 2 millimeter thickness of bone. In order to conserve bone, the crown was severed from its root with a crosscut fissure bur and removed. The root was delivered through the space formerly occupied by the crown of the tooth. A thorough débridement of the bony defect was made. The mucoperiosteal flap was sutured with 000 dermal in its normal position.

Postoperative course.—The patient was advised not to yawn widely or to bite anything hard or tough, because of the possibility of fracturing his mandible. He was put to bed with an ice bag on his lower jaw. Codeine sulfate grain $\frac{1}{2}$ with aspirin grains 10 was all that was required for sedation. The first postoperative day, the patient experienced no great degree of pain and had a moderate amount of edema of the labial soft tissues. The patient noted a paraesthesia of his lower lip, which, no doubt, was due to trauma to the mental nerves as a result of retracting the tissue. The patient had an uneventful recovery. The lower anterior teeth retained their vitality. The paraesthesia existed for a period of 3 weeks after which time sensation gradually returned to normal.



CHEMICAL BURN OF THE ESOPHAGUS

Report of a Case From Occupation Forces in Japan

JOSEPH ROBERT FOX

Lieutenant, junior grade (MC) U. S. N. R.

Medical emergencies confronting the military physician with occupation forces have shifted from those caused by the violence of combat to accidents of a nonviolent nature which may occur in any well populated community. The purpose of this case report on a Marine private who inadvertently drank some glacial acetic acid and suffered a severely burned food passageway is to emphasize the treatment of chemical burns of the esophagus to avert sequelae which may cause permanent damage to the patient.

CASE REPORT

Three nights previous to his admission to Corps Evacuation Hospital No. 3, a 21-year-old Marine accidentally swallowed a small quantity of liquid glacial acetic acid. Immediately upon recognizing his error he expectorated, rinsed his mouth with water, and gulped approximately two glasses of water to quiet the intense burning sensation beneath his sternum. Simultaneously an uncontrollable cough caused transient respiratory embarrassment during which fumes and acid secretions were aspirated. Within a few minutes the patient found he was aphonic, was unable to swallow even his mouth secretions, and was distressed by painful burning sensations in his throat and chest.

The following day he attempted, unsuccessfully to swallow water and due to the pain and burning created by deglutition further attempts were discouraged. He was able to phonate only with great effort emitting a very feeble voice. Any talking caused considerable discomfort. There was a productive cough with frothy mucoid secretion which on the second day following the accident became blood streaked. All mouth secretions had to be expectorated and periodically their overflow into the larynx caused spasms of coughing.

When the patient came under our observation his relevant physical findings were limited to the head and neck examination. The eyes, ears, and nose were negative. The mucosa covering the posterior wall of the oral pharynx, the faucial pillars, the uvula, and the laryngeal pharynx was swollen and intensely injected. By mirror laryngoscopy the epiglottis was swollen, very red and revealed ulceration along the margin at the left base. Both pyriform sinuses were filled with frothy white secretion. Motility of the larynx was normal. The vocal cords appeared uniformly pink and swollen although no ulceration or definite denuding of their surfaces could be distinguished. The mucosa of the arytenoids and false cords was hyperemic. On palpation of the neck there was considerable tenderness over the thyroid cartilage, cricoid cartilage and trachea. The anterior margins of both sternocleidomastoid muscles were tender though no lymphadenopathy could be palpated.

On admission intravenous fluids were instituted to combat the dehydration of the preceding 2 days. Bismuth subcarbonate to dissolve on the tongue was given every 2 hours in an effort to coat the irritated areas. All other medications and food by mouth were withheld until an evaluation of the burned area could be made.

On the fourth day following the accident, the first hospital day, the patient's symptoms had diminished and mirror examination of his laryngopharynx showed a slight decrease in the initial inflammatory reaction. In view of this improvement a barium study was carried out to determine the patency of the esophagus since any severe degree of obstruction would necessitate gastrostomy to insure adequate feeding during convalescence and in the event of structure to facilitate future retrograde dilatations.

Although no fluoroscope was accessible a satisfactory roentgen examination of the esophagus was made using very thin barium. These films showed narrowing of the esophagus at the level of the suprasternal notch; but a lumen sufficient to permit passage of a feeding tube was present.

A number 14 French, whistle tip, soft rubber catheter was passed through the nose. Strained liquid feedings, using a glass funnel and 6-inch rubber tubing with a glass medicine dropper adaptor, were given at 4-hour intervals in sufficient quantity to maintain the patient's nutritional state. The tube was not left in situ permanently, due to the danger of chondritis of the cricoid and thyroid cartilages since these areas were already tender to palpation. This regimen along with bismuth subcarbonate was continued during the next 10 days

until the patient was entirely symptom free. Liquids by mouth were then permitted.

The larynx improved with vocal rest so that in 10 days the vocal cords appeared normal and there was no hoarseness. The productive cough decreased, blood streaking disappeared, and the quantity of sputum became negligible by the fourteenth day. The patient was subsequently evacuated to a rear area naval base hospital.

COMMENT

The important therapeutic measures to be taken following a chemical burn of the esophagus are:

1. Nothing by mouth until an evaluation of the burned area can be made.
2. Intravenous fluids to maintain nutrition.
3. Barium studies of esophagus with a fluoroscope and roentgen ray when the initial inflammatory reaction has subsided.
4. Passage of a small feeding catheter when an adequate esophageal lumen is present; gastrostomy if inflammatory obstruction is severe.

In the event a gastrostomy must be done, it is important to have the patient swallow a thread of strong silk when the initial inflammatory reaction has subsided. The proximal end of this thread is then drawn through the nose while the distal end is brought through the gastrostomy opening. The two ends are knotted and the loop taped behind the patient's ear. This thread through the esophagus insures against losing the lumen when cicatricial changes occur in the healing process and also affords a foundation for future retrograde dilatations.

Because cicatricial strictures do not develop until 4 to 6 weeks following a chemical burn of the esophagus, it is imperative that these patients have fluoroscopic studies of the swallowing function by barium and esophagoscopy examinations to accurately determine the degree of scarring. It is only by these studies carried out during the critical period 6 weeks after the initial damage that a criterion can be established for further treatment of cicatricial stenosis.



THE USE OF PENICILLIN IN DENTAL INFECTIONS

MAYNARD K. ELBURN

Lieutenant (DC) U. S. N. R.

Penicillin was first tried at the Naval Operating Base at Adak, Alaska, in cases of dental infections, using the same systemic method of intramuscular injections that was used for infections occurring in

other regions of the body. The patient was hospitalized, put on prescribed medication, and checked regularly.

The first dental case in which penicillin was used at this activity, was a cellulitis of the maxillary region that developed from a previously filled pulp canal. The cellulitis failed to respond to the usual treatment procedures, and thrice returned to an acute stage. The patient was then hospitalized and given 20,000 units of penicillin in 2 cc. of normal saline solution, administered by intramuscular injections every 3 hours for 48 hours. At the end of 48 hours, the acute condition had subsided; however penicillin was continued for another 24 hours, and then a root canal filling was inserted and an apicoectomy was performed. The postoperative healing was uneventful.

Penicillin in this manner, was used thereafter in various types of soft tissue infections. The use of penicillin proved a valuable adjunct in treating these acute conditions. The 48-hour penicillin treatment along with warm saline rinses brought these cases to a chronic stage where surgical or operative treatment could be safely and successfully performed.

However, at a later date, as personnel problems arose and time loss from duty became an important factor, the hospitalization method became awkward and was used only in extremely serious conditions. With this problem in mind, a method of local injections of penicillin directly adjacent the site of infection was started.

LOCAL INJECTIONS OF PENICILLIN

Beginning first with a referred case of severe pericoronitis, 20,000 units of penicillin in 2 cc. of normal saline solution was injected directly into the pericoronal region with a dental syringe. The results were extremely gratifying. Twenty-four hours after the initial injection the soreness and swelling had greatly subsided. Then 24 hours after the second injection the tissues had assumed a normal appearance and the patient reported all soreness gone. Ten other cases of pericoronitis showed that direct injection into the region of infection with penicillin brought excellent results and required fewer injections than the systemic method. Direct injections were then used in cases of infected impacted lower third molars, in one case of an early stage lateral abscess, and in various cases of cellulitis. Fewer injections and shorter periods of treatment were required with direct injections than with the earlier used method of intramuscular injections.

DISCUSSION

During later treatments, it developed that the use of sterile water as the medium for penicillin proved less irritating to the tissues than

normal saline solution. Sterile water also cut down the complaints of "a burning sensation" upon injection that some patients experienced when saline had been used. The use of epinephrine hydrochloride in the dilution of 1:50,000 with the penicillin, gave better results than penicillin alone. The penicillin deposited directly into the region of infection seemed to be more effective than that carried there by the blood stream from another area. The precaution, oft repeated, of not injecting into an infected area does not seem to apply to penicillin. Every case had been observed and checked, with no harmful reaction in any of more than 24 cases. The use of epinephrine hydrochloride to keep the penicillin in the infected region for longer periods of time seemed to increase the effectiveness of the penicillin in its bacteriocidal action. On the average, two injections 24 hours apart were used to bring the infection to a chronic stage, however the amount of penicillin was increased to 50,000 units per cc. and 2 cc. of solution used in each injection. The number of injections, however, were dependent upon the individual case and conditions. Penicillin gives better results when used in the inflammatory period, rather than when the case reaches a purulent abscessed stage.

CONCLUSIONS

1. Penicillin has proved useful in various cases of dental infection.
2. The method of oral injections, directly to the site of infection has given faster and more satisfactory results than the systemic method.
3. The direct method seems ideally suited for the dental officer. He can administer the penicillin in his office, with no need for hospitalization, and no duty time loss for the patient.
4. The results of direct oral use of penicillin in soft tissue infections have been very promising, and seems to warrant further work and investigation.



BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

ESSENTIALS OF ENDOCRINOLOGY, by Arthur Grollman, Ph. D., M. D., F. A. C. P.,
Professor of Medicine and Chairman of the Department of Experimental Medicine, the Southwestern Medical College; Attending Physician and Consultant in Endocrinology, the Parkland Hospital, Dallas, Texas. 2d edition
644 pages; 132 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1947, price \$10.

This is one of a small number of books in which human endocrinopathy is presented systematically against an authoritative background of endocrine physiology. Its primary emphasis is always upon the human being, but animal experimentation is abundantly cited where it throws light upon the clinical picture. The reviewer's first impression was that Dr. Grollman had subordinated too completely some of the newer research in endocrine physiology, but it appears likely that he was only following a conservative course in omitting controversial material to make room for that which was better established. Those who wish a more detailed discussion of experimental evidence will find it in the journals and in review volumes like "The Chemistry and Physiology of Hormones"; the medical man interested in advanced practical orientation will find Grollman's volume most useful.

The book has five main divisions based upon the anatomical location of the various endocrine organs. Each gland is described fully as to its anatomy, physiology and pathology, and the chemistry and toxicology of its hormones. Grollman rightly distinguishes between the glandular products which we isolate and imitate by synthesis and the mother substances which the glands elaborate; such a distinction leads to careful consideration of the use of commercial products. With regard to the latter, he has compiled a useful table giving the glandular

source of many hormones, their scientifically acceptable names, some commercial designations, standardization and units, and a reference to the text. Over a hundred illustrations, a good index and numerous references after each chapter are some of the other useful features of the book.

THE CHEMISTRY OF ANESTHESIA, by John Adrian, M. D., *Director, Department of Anesthesia, Charity Hospital of Louisiana at New Orleans; Clinical Assistant Professor of Surgery, Louisiana State University School of Medicine*. 536 pages; numerous illustrations. Charles C Thomas, Springfield, Ill., publishers, 1946. Price \$7.

The "Chemistry of Anesthesia" is clearly written and should be particularly valuable to anesthetists and students of anesthetics. Since the author purposely developed his book for anesthetists and clinicians one cannot expect to find material of special interest to the research worker. The author, however, accomplishes well the task he set out to achieve.

The book is divided into three parts. Part I deals with the inorganic phases of chemistry related to anesthesia. Part II deals with organic chemistry which is essentially the chemistry of depressant drugs. Part III deals with the biochemical aspects of anesthesia and is devoted to the chemical changes in tissues induced by the administration of anesthetic drugs to man and animals.

A working background in chemistry is essential for the proper administration of anesthetic agents and this book properly evaluates the basic sciences and places them at the convenience of the reader. The bibliography is extensive and should be of great value, even to the research worker. However, the scope of the book is definitely not pointed at the chemist, pharmacologist, or other research workers.

The author has taken considerable pains to evaluate and describe the tools and gas analysis technics essential to good anesthetic practice. Since the book is pointed for the practicing anesthesiologist, it would have been more desirable to have included a description of the recently developed simple automatic gas analysis instruments and stressed less the more tedious and complicated technics. No mention was found of the Pauling oxygen meter, Dyer CO₂ apparatus, or the Scholander technics.

The book should be of value to any individual or group dealing with anesthetics or related fields.

QUANTITATIVE CLINICAL CHEMISTRY INTERPRETATIONS, Volume I, by John P. Peters, M. D., M. A., *Professor of Internal Medicine, Yale University School of Medicine* and Donald D. Van Slyke, Ph. D., Sc. D., *member of the Rockefeller Institute for Medical Research*. 2d edition. 1041 pages; numerous illustrations. The Williams & Wilkins Company, Baltimore, Md., publishers, 1946. Price \$7.

Quantitative Clinical Chemistry Interpretations, is clearly and authoritatively written and should be of inestimable value to research workers in the medical sciences and to medical students and practitioners. The book has more than lived up to its expectations.

Interpretations, Volume I, is divided into four parts. Part I deals with energy metabolism; Part II, Carbohydrate—chemistry, physiology, clinical; Part III, Lipids—lipids, steroid hormones, fat soluble vitamins; Part IV, Protein Metabolism—the net metabolism of protein, amino acids, urea, ammonia, creatin and creatinine, purines and pyrimidities. The publisher promises a second volume in the near future to include phases not covered by Volume I, namely, oxygen and hemoglobin, plasma proteins, and inorganic elements.

Like its 1928 edition, the text is thorough in spite of the many apologies made by the authors as to its shortcomings. It is as thorough as anything can be in a rapidly changing world. Its bibliography is voluminous; however, it is pertinent to the text. The book should be of immense value to students and research workers undertaking a new field of endeavor.

The book has a great deal of new and useful information to offer research workers, clinicians, practitioners, or students of medical sciences.

THE ANATOMY OF THE NERVOUS SYSTEM, Its Development and Function, by Stephen Walter Ranson, M. D., Ph. D., *Late Professor of Neurology and Director of Neurological Institute, Northwestern University Medical School, Chicago*. 8th edition revised by Sam Lillard Clark, M. D., Ph. D., *Professor of Anatomy, the Vanderbilt University School of Medicine, Nashville*. 532 pages; 417 illustrations, 14 in color. W. B. Saunders Company, Philadelphia, Pa., publishers, 1947. Price \$6.50.

This first revision of Ranson's textbook following his death has been carried out by one of his former collaborators. The eighth edition preserves in general the form and language of the seventh. Minor changes in wording, order of presentation, and paragraphing have made the book easier to read. Descriptions of the gross anatomy of the nervous system and the meninges and blood vessels have been collected in two chapters immediately following the introductory chapter in order to facilitate the study of internal structure in succeeding chapters.

A few new illustrations have been added, including a series of photographs of parasagittal sections of the brain stem stained by the Pal-Weigert method. These latter are not as effective as they might be because of poor reproduction.

A small number of new references are incorporated. Among the topics given more extensive revision in the light of recent research are the principles of axonal growth, chromatolysis, degeneration and re-

generation of nerve fibers, the principle of segmental innervation, the extrapyramidal connections of the cerebral cortex, and the precentral motor cortex.

CLINICAL CYSTOSCOPY, by Lowrain E. McCrea, M. D., F. A. C. S., *Associate Professor of Urology, Temple University Medical School. Attending Urologist, Philadelphia General Hospital.* 1078 pages; 667 illustrations; 196 in color. F. A. Davis Co., Philadelphia, Pa., publisher, 1946. Price \$25.

The author of a work such as this must derive a great deal of pleasure and satisfaction from his efforts. It is an important and practical addition to urological literature. The title may be somewhat misleading to the reader expecting a more or less technical treatise on cystoscopy. Instead he finds himself confronted with a complete text of those urological conditions in which cystoscopy is a feature.

As is well known, Dr. McCrea has pioneered intravesical photography. Through his untiring efforts a workable cystoscopic camera has been developed with the resulting unrivaled color photographs of the normal and pathological bladder. It is now possible for the interested practitioner to inspect exact reproductions of the common as well as the rare conditions of the bladder and urethra as seen cystoscopically.

The text is written in a simple and readable manner. Included are all the known diseases in which cystoscopy plays a diagnostic or therapeutic part. The discussion of the clinical entity is developed in such a manner as to give a clear picture of each condition. Particular stress is placed on cystoscopic technic and findings. The most recondite of conditions by such an orderly progression becomes a logical diagnostic and therapeutic problem. Therapy, particularly that accomplished cystoscopically, is discussed in sufficient detail. When roentgenology can be utilized in the diagnostic procedure, adequate discussion of these findings are given.

The illustrations, which are numerous, are particularly good. As has been mentioned, the first use of actual cystoscopic color photographs of the vesical interior for textbook illustration are excellent. These are supplemented by colored drawings, photographic reproductions of x-ray studies, photomicrographs of pathological studies and, when necessary, diagrammatic representations of certain conditions.

RENAL DISEASES, by E. T. Bell, M. D., *Professor of Pathology, University of Minnesota, Minneapolis, Minnesota.* 5th edition. 434 pages, illustrated with 115 engravings and 4 color plates. Lea & Febiger, Philadelphia, Pa., publisher, 1946. Price \$7.

Bell, in his monograph on "Renal Diseases," has a delightful combination of pathology, physiology, and clinical medicine. For a treatise of its size it is remarkably complete. The text is lucid, authoritative,

and presented in a logical manner. References to pertinent literature are numerous and are supplemented from the author's extensive experience. The principles of treatment are outlined but as the author states in his preface, "the reader is referred to special papers for the details of therapy."

Of particular value in this book is that section which deals with hypertension and its relation to renal disease. The many problems concerning this condition which plague the busy clinician are discussed and clarified.

The text is supported by numerous and excellent photomicrographs of pathological studies. There are 73 tables for the reader's reference.

This book can be recommended without reservation to both the general practitioner and specialist as a practical and authoritative manual of the renal diseases.

GYNECOLOGICAL AND OBSTETRICAL PATHOLOGY, with Clinical and Endocrine Relations, by Emil Novak, A. B., M. D., D. Sc. (Hon. Dublin) F. A. C. S., *Associate in Gynecology, The Johns Hopkins Medical School*. 2d edition. 570 pages; 542 illustrations, 15 in color. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$7.50.

In this second edition, the author has had many revisions and additions to make. The present edition, with all references, has been brought up to date. The size and value of the book have been increased over that of the first edition. Anyone doing obstetrics and gynecology often wishes he had a compact, well illustrated, up-to-date book on the pathology of these subjects. Doctor Novak has compiled just such a book. It is not a volume which discusses every idea on the subject, but sets forth the author's own ideas and experiences in a very complete manner, with brief discussion of the ideas of other leading men on the subject. The references are full so that further study may be carried out if one desires all the "pros" and "cons" on any subject.

The volume is divided into 34 chapters, 33 of which are by the author plus a concluding chapter by Dr. L. M. Hellman on "Abnormalities and Diseases of the Placenta and Appendage (Other Than Hydatidiform Mole and Chorionepitheloma)." The author has interwoven just enough of the clinical side of the conditions for maximum correlation between the clinical and the pathological in the mind of the reader. Since the author is especially outstanding in the field of female endocrine pathology, his chapter relating to this subject with which he opens his book is especially stimulating. His 12 chapters on diseases, embryology, histology, and neoplasms (both benign and malignant), of the ovary have been most paintakingly done. The book is well written and makes delightful, as well as instructive reading.

There are well over a hundred more illustrations in this volume than in the preceding edition. However, there are only 15 illustrations

in color, and herein lies the only, even minor, weakness of this book. More color illustrations of gross specimens would aid in giving the reader a real life appearance of the diseased organ. The microscopic illustrations are excellent and would not lend themselves readily to color reproduction. The large number of illustrations greatly increases the value of the book, since, with a reading glass one may study them almost as thoroughly as if one were using a microscope.

Doctor Novak has covered every conceivable obstetrical and gynecologic pathological condition to some degree. He has, therefore, produced a book which is of practical value to both the clinician and pathologist alike. It is of especial value to those training for obstetrical and gynecological specialties.

TEXTBOOK FOR PSYCHIATRIC ATTENDANTS, by Laura W. Fitzsimmons, R. N., B. S., M. A., *Assistant Director of Nurses, and Chief Neuropsychiatric Nurse, United States Veterans' Administration; Chairman, Committee on Psychiatric Nursing, National League of Nursing Education. Formerly Nursing Consultant, American Psychiatric Association, and President of Nurses' Examining Board, District of Columbia.* 332 pages. The Macmillan Company, New York, N. Y., publishers, 1947. Price \$3.50.

This book is primarily meant as a text to standardize the course of training for attendants in mental institutions, to give the attendant a clear understanding of his patient, his duties, his responsibility to his patient, and an intelligent knowledge of his patient's proper care. As such, it serves that purpose well. The material is comprehensive and relevant, though some space is wasted in dissertation which would have been more forceful had it been more brief, and there is occasional repetition. The text appears based on the facts that knowledge of the subject means more intelligent care of the patient and effectiveness of effort increases with training and knowledge, so a particularly lucid, composite picture is presented of the mental patient and his care from earliest recognition and treatment to types and scientific treatment of today.

Important facts in general physical and psychological nursing care and care of mental patients according to group classification are detailed and carefully explained. Precautions in general, in connection with various types of mental disease, and types needing closest observation and when they should be put under close observation are discussed with skill. Material on prevention of suicide and first-aid methods is concise, but adequate. Nursing procedures given are well selected and capably described and a satisfactory daily schedule for the patient is planned and outlined. General rules of health and hygiene, with physical effects on the patient of certain mental concepts, are briefly considered. Valuable instruction is given on nutrients and their functions, dietary needs of the patient, foods allowed on standard diets, preparing foods, serving trays, feeding the patient, and

on ward housekeeping; the ward set-up, care of units, equipment and supplies.

The special therapies used in treatment of these patients, the mental preparation of the patient for them, technique of the most important treatments and crafts, precautions in connection with them, observation of patient's reaction, after care, and recording are capably discussed. Definitions, explanations and suggested reference reading are excellent.

THEORY OF OCCUPATIONAL THERAPY, by Norah A. Haworth, M. A. (Cantab.), M. R. C. S., L. R. C. P., D. P. M., *Industrial Medical Officer* and E. Mary MacDonald, *Principal, Dorset House School of Occupational Therapy* with Foreword by Sir Robert Stanton Woods, M. D., F. R. C. P., *Consultant Adviser in Physical Medicine to the Ministry of Health. Physician in charge of the Department of Physical Medicine at the London Hospital.* 3d edition. 158 pages; numerous illustrations. The Williams & Wilkins Company, Baltimore, Md., publishers, 1946. Price \$2.50.

This is an excellent book, well written and up to date. It is condensed and pertinent, valuable as a text for student and nurse, and as reference for graduate therapist and assistants. Wherever the well-being or recovery of a patient may be aided by occupation, the book will be of value. In it, the value and scope of occupational therapy, its functions, application, aims and possibilities are capably discussed. The background and history of occupation and its effects on the sick from early years, 2,000 B. C. to scientific treatment of today, are carefully related.

Instruction on department organization, management, records (patient and office), and financing in hospitals, industry, and special training centers are definite and complete. Duties of the therapist, to whom she is responsible, relation to patient, her association with other departments, qualities and knowledge she should have and application of that knowledge are meticulously explained. Adequate instructions are given for organizing physical exercises and occupational therapy classes in hospital wards with exercises listed according to fitness of patient. Directions are given on therapy of value to ward nurse. Exceptionally good instructions are given for preparing a "Scrap-book" of well-selected crafts and for making contents listed.

In orthopedic therapy, reeducation of muscles and joints and prevention of atrophy are stressed. Crafts are listed to suit individual needs and particularly apt suggestions are made for occupations with joint movement involved. The outline for progressive curative treatment is excellent. Establishing degree of disability in medical cases, planned treatment, principles and precautions are carefully considered. Suitable crafts are listed with pertinent facts about the disease. Therapy of mental disorders deals with an authoritative analysis of different abnormalities, symptoms, an adequate list of occupations

(both stimulative and sedative) and reasons for choice of these occupations. A concise, comprehensive program is presented for use in habit-training centers. The importance of relaxation, diversional and therapeutic, and of hobbies is ably explained.

Advantages are given of rehabilitation in industry of convalescent patients. Group classification, productive and therapeutic occupations under medical supervision in factory or special rehabilitation shop, and check-up of patients are skillfully outlined and defined. List of occupations according to joint action necessary in manipulation is well prepared and informative.

An excellent, well illustrated list is presented of supplies, materials, apparatus, equipment and tools necessary for various occupations, assembly of which is simplified by detailed directions. Ways are mentioned in which waste material may be utilized.

Bibliography presented is suitable, detailed and complete.

MOTHER AND BABY CARE IN PICTURES, by Louise Zabriskie, R. N., *Director, Maternity Consultation Service, New York City; Lecturer, New York University; formerly Night Supervisor, Lying-In Hospital, New York City; Field Director, Maternity Center Association, New York City.* 3d edition, modernized. 203 pages; 229 illustrations and 7 tables. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1946. Price \$2.

A comprehensive book, as intended, for nonprofessional groups such as prospective parents, high school and college students, for those of restricted training, as nurses' aids, and for teachers of these groups. Partially trained attendants in isolated areas who, at times, have to officiate at deliveries, give pre- and post-natal care and care for baby and young child in absence of physician, also will find the book a valuable source of pertinent information, though the book would have been of more value to this group had the immediate after-care of mother and baby been described more fully. Information presented is in logical sequence and is of a most practical nature. Illustrations are many and are excellent in selection and detail, covering the wide range of the prenatal period, stages in development of the fetus, labor, the delivery, postnatal care, and care of the baby from birth until well beyond his first year. Outlines, diagrams, tables, and charts are well prepared and readily understandable. Wisely chosen explanatory remarks accompany these illustrations.

Prenatal care is carefully explained and foods are listed for proper diet for the expectant mother. Maternity clothes are described and illustrated and a complete layette is planned for the baby. Postnatal care includes care of the breasts, application of binders, diet and exercise. Preparations for labor and delivery, with set-up of delivery room in hospital and home, are skillfully illustrated and described in detail. Symptoms of labor are given with maternal discomforts, both pre- and post-natal are mentioned, and treatments suggested for their

relief. Excellent methods are given for insuring proper identification of baby.

Baby care, adequately illustrated, gives step-by-step directions for bath, how to handle baby, weigh him, take his temperature, administer an enema and relieve his probable discomforts. A complete daily schedule, capably planned and outlined, is presented with expert information on his habits and training. Detailed directions are given for preparing his formula, planning his diet as he gets older, and care of formula and feeding equipment, and an "average weight" chart and diagram showing times for various teeth to appear are valuable aids in checking his progress. Well-prepared material is presented on preventive care of various diseases. A carefully compiled chart on infectious diseases: onset, period of infectivity, symptoms, complications, and immunization is exceptionally complete and instructive.



PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



PULMONARY TUBERCULOSIS: REVIEW OF SIXTY-SIX CASES WITH ANATOMICAL FINDINGS

SIDNEY A. BRITTEN
Commander (MC) U. S. N.

Of 105 reports of death from tuberculosis received in the Bureau of Medicine and Surgery during the period 1 June 1944 to 1 April 1947, 66 (62.8 percent) contained a record of postmortem examination. The reports of death, together with the health records, central records, and, when available, the photofluorographic film of the chest made before or soon after entry upon active duty, were reviewed.

The cases were separable into three groups: (a) generalized miliary tuberculosis where the source of dissemination was either unknown or unassociated with evidence of preexisting pulmonary infiltration, (b) pulmonary tuberculosis with intracanalicular dissemination (1), such as laryngeal, intestinal, and intrabronchial involvement, and (c) pulmonary tuberculosis with lymphohematogenous dissemination, such as generalized miliary, meningeal, renal, skeletal involvement, etc. Many of the patients in group (b) suffered involvement of the regional lymph nodes; a patient was not classified in group (c) unless lymphohematogenous dissemination had extended beyond the regional lymph node barrier.

TABLE 1.—*Pulmonary tuberculosis: Number by age at enlistment. 66 cases*

Type of tuberculosis	Race	Total cases	Age at enlistment			
			17-21	22-26	27-34	Over 34
Disseminated miliary, without evidence of preexisting pulmonary tuberculosis.	{ White	6	6			
	{ Other	1		1		
Pulmonary ¹ with intracanalicular dissemination:	{ White					
	{ Other					
Minimal at admission	{ White					
	{ Other					
Moderately advanced at admission	{ White	5	4	1		
	{ Other	5	4		1	
Advanced at admission	{ White	10	6	1	3	
	{ Other	2	2			
Pulmonary with lymphohematogenous dissemination.	{ White	19	9	5	4	1
	{ Other	15	11	2	1	1

¹ All but 1 far advanced at death.

Sixty-six percent of the patients were less than 22 years of age at enlistment, 65 percent had been on active duty more than 12 months but less than 49 months before admission, 62 percent had noted first symptoms less than 4 months before admission, and 71 percent died within 6 months after admission. Of the 41 instances in which the preservice x-ray film of the chest was available for review, 68 percent were negative in the sense that they disclosed no evidence considered disqualifying.

Sixty-eight percent had far advanced pulmonary lesions; the remainder were moderately advanced or miliary. Ninety-five percent presented themselves for examination; the remainder were discovered by routine x-ray examination of the chest.

Fifty-nine percent were on duty within the United States when admitted.

TABLE 2.—*Early symptoms disclosed by questioning duration—1 to 19 months*

	White				Other			
	Miliary	Pulmonary with intracanalicular dissemination	Pulmonary with lymphohematogenous dissemination	Total	Miliary	Pulmonary with intracanalicular dissemination	Pulmonary with lymphohematogenous dissemination	Total
Weight loss.....	1	9	12	22	1	—	1	2
Cough.....	—	6	8	14	1	2	1	4
Anorexia.....	—	4	5	9	—	—	1	1
Fatigue.....	1	2	4	7	1	2	2	5
Fever.....	—	2	3	5	1	—	1	2
Chest pain.....	—	3	2	5	—	1	—	1
Night sweats.....	—	2	2	4	—	—	—	—
Cold.....	—	3	1	4	—	—	—	—
Malaise.....	—	2	1	3	—	—	—	—
Hoarseness.....	—	1	2	3	—	—	—	—
Rheumatism.....	—	1	1	2	—	—	—	—
Dyspnea.....	—	1	1	2	1	—	1	2
Abdominal pain.....	—	2	—	2	—	—	1	1
Diarrhea.....	—	1	1	2	—	—	1	1
Constipation.....	—	1	—	1	—	—	—	—
Indigestion.....	—	1	—	1	—	—	—	—
Hemoptysis.....	—	1	—	1	—	—	—	—
Headache.....	—	—	—	—	—	—	1	1
Frequency.....	—	—	1	1	—	—	—	—
Lymphadenopathy.....	1	—	—	1	—	—	—	—

Table 2 lists the symptoms which preceded, by at least 1 month, the symptoms for which the patients sought relief. Loss of weight, cough, poor appetite, and fatigue were most frequent. However, several of the patients had predominately gastro-intestinal complaints and two had complained of, and been treated for, rheumatism (2).

Table 3 lists the symptoms and conditions for which the patients were admitted to the sick list. In contrast to the earlier complaints, fever, cough, colds, and chest pain were the most frequent. Prominent among the diagnoses for which the patients were treated immediately after admission were atypical pneumonia, lobar pneumonia,

TABLE 3.—*Presenting symptoms at admission duration—1 to 30 days*

	White				Other			
	Miliary	Pulmonary with intracanalicular dissemination	Pulmonary with lymphohematogenous dissemination	Total	Miliary	Pulmonary with intracanalicular dissemination	Pulmonary with lymphohematogenous dissemination	Total
Fever.....	5	4	10	19	4	11	15	
Cough.....	2	3	4	9	5	7	12	
Cold.....	3	2	3	8	3	6	9	
Malaise.....	2	1	3	6	2	5	7	
Pneumonia.....	2	2	2	6	2	3	5	
Chest pain.....	1	1	2	4	1	7	11	
Fatigue.....		1	2	3	1	3	4	
Hoarseness.....		3		3	1	2	3	
Effusion.....	1	1	1	3	1	2	3	
Weight Loss.....		1	1	2		1	2	
Hemoptysis.....		1	1	2		3	4	
Abdominal pain.....			2	2	1	3	4	
Anorexia.....	1	1		2		3	3	
Rheumatism.....	1		1	2		1	1	
Headache.....			1	1		3	4	
Chills.....		1		1	1	3	4	
Diarrhea.....			1	1		2	2	
Constipation.....		1		1				
Tachycardia.....		1	1	2			1	
Dyspnea.....			1	1			1	
Otitis media.....		1		1			1	
Indigestion.....			1	1				
Night sweats.....			1	1				
Frequency.....						1	1	

rheumatic fever, appendicitis, and malaria; not until sputum analyses or chest roentgenograms were requested was the correct diagnosis established in these instances.

Tables 4, 5, and 6 contain the length of service before symptoms appeared, before admission to the sick list, and before death in each category, together with the result of review of the preservice chest x-ray film.

TABLE 4.—*Miliary tuberculosis unassociated with preexisting pulmonary tuberculosis*

Race	Age at enlistment	Months of service			Preservice chest film				Possible source of dissemination
		Before symptoms	Before treatment	Before death	Negative at interpretation	Negative at interpretation and review	Negative at interpretation—positive at review	No film	
White.....	18	17	18	19		+			Caseous prostate.
Negro.....	25	8	11	13	+				
White.....	18	5	6	12		+			Sarcoid.
Do.....	18	232	236	238				+	
Do.....	18	26	26	29	+				
Do.....	17	2	8	16				+	
Do.....	18	32	32	33	+				

All but one patient had died within 12 to 33 months of service; of these only one was over 18 years of age at enlistment. The longest duration of illness, from the earliest symptom, was 14 months; this

patient had been previously diagnosed as Boeck's sarcoid following biopsy. One patient had been on active duty in the Navy for 19 years before the earliest symptom of his terminal illness.

TABLE 5.—*Pulmonary tuberculosis—intracanalicular and sentinel node dissemination*

Race	Number	Months of service (average)			Preservice chest film			
		Before symptoms	Before admission	Before death	Negative at interpretation and review	Negative at interpretation. Suspicious at review	Negative at interpretation. Positive at review	No film
White	15	108	113	119	4 (50%)	3 (38%)	1 (12%)	7
Other	7	17	21	26	3 (50%)	2 (33%)	1 (17%)	1

All the non-Caucasians had less than 48 months of service prior to admission. When Caucasians with similar lengths of service are considered, the average length of service was 23 months before symptoms, 25 months before admission, and 32 months before death.

TABLE 6.—*Pulmonary tuberculosis—lymphohematogenous dissemination*

Race	Number	Months of service (average)			Preservice chest film			
		Before symptoms	Before admission	Before death	Negative at interpretation and review	Negative at interpretation. Suspicious at review	Negative at interpretation. Positive at review	No film
White	¹ 18	38	42	48	8 (73%)	2 (18%)	1 (9%)	7
Other	15	15	18	23	11 (79%)	2 (14%)	1 (7%)	1

¹ 1 white male complained of symptoms after 1 month of service; symptoms had existed 8 years; death occurred less than 1 month after admission to the sick list. He was not included in the table.

Leukocytosis was present in only 15 percent of these advanced cases at or soon after admission, a fact which may have had a bearing on the rather frequent admission diagnosis of atypical or virus pneumonia. Eosinophilia was reported in only one instance; a patient with miliary dissemination. The sedimentation rate was accelerated in 97 percent of the patients for whom the test was made; normal in 3 percent. Bacillary confirmation was reported in 90 percent of the pulmonary cases.

Treatment was, in the main, symptomatic. Artificial pneumothorax was induced in 22 patients; in 1 instance death from coronary air embolism occurred during the induction. Repeated thoracenteses were required for 6 patients, drainage of abscess for 1. Penicillin was employed in 18 cases, sulfa drugs in 17, and streptomycin in 1.

The progress of the patient's illness was generally inexorably unfavorable.

TABLE 7.—*Pulmonary tuberculosis with intracanalicular dissemination—
anatomical findings*

Pathology	White	Other	Pathology	White	Other
Tracheobronchial nodes	2	4	Miliary, pulmonary	2	
Mesenteric nodes	3	3	Mediastinal emphysema		1
Cervical nodes	1	1	Cold abscess, rectum	1	
Chronic pleuritis	5	5	Ileum, cecum, or colon	8	3
Pleural effusion	1	1	Appendix	3	1
Empyema	2		Larynx	5	1
Spontaneous pneumothorax	1		Air embolism, coronary	1	
Caseous pleuritis		1	Chronic passive congestion	1	3
Extrapleural hematoma	1		Left and right cardiac hypertrophy	1	1
Bronchopleural fistula	1	1	Right cardiac hypertrophy	1	
Tuberculous pneumonia	2	2	Cloudy swelling, kidneys	1	
Atelectasis	1	1	Laënnec's cirrhosis (incidental)	1	

TABLE 8.—*Pulmonary tuberculosis with lymphohematogenous dissemination—
anatomical findings*

Pathology	White	Other	Pathology	White	Other
Kidney	8	6	Bone	4	2
Spleen	8	3	Mesenteric nodes	7	4
Tracheobronchial nodes	7	9	Cervical nodes	4	
Peritoneum	5	6	Pleural effusion	4	6
Liver	5	3	Larynx	4	2
Miliary	5	1	Bowel	18	4
Prostate	4	1	Chronic pleuritis	12	9
Adrenal	1	3	Epiglottitis	1	
Meninges	1	3	Anal ulcer	1	
Multiple abscesses	2		Tongue	1	
Axillary nodes	1		Spontaneous pneumothorax	2	

Tables 7 and 8 contain the anatomical findings as reported in the pulmonary cases. Not all the autopsies were complete, and frequently they were recorded in summary form.

There seems to have been little difference between the races in regard to the anatomical findings in either of the above categories.

DISCUSSION

Tuberculosis, all forms, was second in the list of diseases causing death in the Navy during the period 1942 to 1945 (3) and as such its importance to the service is reemphasized. Annual Reports of the Surgeon General of the U. S. Navy reflect concern over this disease from their beginning, and great stress has always been placed upon the necessity of excluding persons with the disease from enlistment.

In late 1941, an x-ray of the chest was included as part of the physical examination to determine fitness for active duty. Since June 1944 (4), an annual examination of the chest has been required of personnel on active duty, where facilities were available. An x-ray of the chest is required as part of the physical examination to determine fitness for separation from the service.

While all the measures mentioned above are of great value to the individual, the Navy, and the Nation, they have not completely prevented the catastrophe which is presented when a young man whose

chest film discloses no defect at time of enlistment dies, within 1 to 4 years, of rapidly progressive tuberculosis. Nor have such measures prevented the occasional highly trained man of long and honorable term of service from succumbing to the disease.

It is most unfortunate that the result of a tuberculin test prior to entry upon active duty is not a part of the record in these cases, for without it freedom from infection with tuberculosis is mere presumption, even in the presence of a normal-appearing chest film (5), (6). It is quite possible for persons to acquire the disease and die of it within a very short time; on the other hand infection may be dormant for years and then assume a chronic, subacute or acute course (1).

It seems apparent, from the result of this review, that the military services will have the opportunity to contribute significantly to the knowledge concerning the mechanisms underlying calamitous disease of this sort when routine tuberculin-testing of recruits becomes practicable. For within 2 to 4 years of the inception of a tuberculin-testing program it would become evident who were dying of tuberculosis, those who were infected prior to entering service or those who were uninfected. With that information the services would be in advantageous position for a decision as to the advisability of undertaking immunization procedures, when available (7).

The results of this review also point to the importance of intensifying the search for the nature of immunity in tuberculosis and a simple test for its presence (8).

What would have been the outcome for these patients had the diagnosis been suspected earlier in their illness? Ninety-five percent had developed severely disabling symptoms at the time of admission and of these many underwent treatment for pneumonia, malaria, appendicitis, colitis, peptic ulcer, and rheumatic fever before the true cause of their disability was suspected. This was especially true in the case of the Caucasians where the disease in its early stages was less acute than in the non-Caucasians. Syphilis is known as the "Great Imitator," and medical officers nearly always test with the Wassermann or similar reactions. After consulting tables 7 and 8, one must reiterate the warnings of the standard texts that there is nothing specific in the early symptoms and signs of tuberculosis (9). Use of the tuberculin test and the chest x-ray must be as uniform as serological tests for syphilis, now that they are practically universally available, when patients are losing weight or appetite, catch colds, develop coughs, suffer abdominal pain, indigestion, change in bowel habit, develop "arthritis" or rheumatism, show symptoms commonly interpreted as psychasthenia or neurasthenia, manifest certain rashes, suffer headaches, spit blood or stained sputum, contract "virus" pneumonia. All these symptoms and many more, while nearly always

associated with advanced disease, may occur when the disease is present in minimal degree. In the early stages they may be evanescent or recurrent; in the later stages they are disabling and intractable.

Medical officers who observe their companies with the same deep concern with which they watch over the health of their own families will detect changes in behavior and personality as these symptoms develop, often long before the victim himself is aware that something is wrong. It is not sufficient to rely exclusively on annual chest x-rays, excellent and necessary as they are; instances are on record where pulmonary tuberculosis and miliary tuberculosis of advanced and hopeless degree have appeared in patients within a few months of normal x-ray films of the chest (1).

The Navy's tuberculosis control effort is proceeding apace and the results have been excellent within the limitations imposed by lack of a specific test for immunity (10) (11). The majority of cases found now are in the minimal stage, many arrested or apparently cured; this has resulted from routine x-rays of the chest. Further efforts by clinicians in the detection of early signs and symptoms of illness, and a high index of suspicion will strongly implement that effort. When a method of immunization has been perfected, the goal will be approached.

SUMMARY

The result of review of 66 records of patients who died in naval service from tuberculosis have been presented, together with the anatomical findings and a review of the x-ray films of the chest made before or soon after entering active duty.

The cases were moderately or far advanced when discovered, were, in general, of relatively short duration, acute in course, frequently mistaken for other diseases, and intractable to treatment.

Of the patients whose preservice films were available for review, over 50 percent entered service with normal x-ray findings.

The result of the tuberculin test prior to naval duty is not known.

REFERENCES

1. PINNER, M.: Pulmonary Tuberculosis in the Adult. Charles C Thomas, Springfield, Ill., 1945.
2. SELIGSON, F.: Poncet's disease; clinical observations on inflammatory and degenerative joint reactions in tuberculosis. *Am. Rev. Tuberc.* 52: 463-473, Dec. 1945.
3. Annual Reports of the Surgeon General, U. S. Navy, 1942-1945. Data for 1945 tentative pending publication.
4. Manual of the Medical Department, U. S. Navy. Paragraph 21103.
5. HILLEBOE, H. E.: Guide for disposition of persons with abnormal pulmonary findings on x-ray films. *Public Health Reports.* 61: 1759-1769, Dec. 6, 1946.

6. MYERS, J. A.: *Tuberculosis Among Children and Young Adults*. 2d edition. Charles C Thomas, Springfield, Ill., 1938.
7. Editorial Notice: *American Review of Tuberculosis*. **55**: 105, 1947.
8. OGDEN, W. E., et al.: *Foreseeing and forestalling tuberculosis, a symposium. Diseases of Chest* **12**: 277-329, 1946.
9. CECIL, R. L.: *Textbook of Medicine*. 6th edition. W. B. Saunders Company, Philadelphia, Pa., 1943.
10. BEHRENS, C. F., and BRITTEN, S. A.: *Five years of photofluorography in the Navy*. U. S. Nav. M. Bull. **45**: 1203-1207, Dec. 1945.
11. BRITTEN, S. A.: *Photofluorographic examinations of the chest of all Navy and Marine Corps personnel, 1944-1945*. U. S. Nav. M. Bull. **46**: 1479-1481, Aug. 1946.



POTENTIAL MERCURY VAPOR HAZARD IN A GYRO LABORATORY

CLARK P. JEFFERS

Commander (MC) U. S. N.

GUIDO J. ROSATI

Lieutenant, H(S) U. S. N. R.

and

FRANK A. JACKSON

Lieutenant, H(S) U. S. N. R.

Routine inspections of the gyro laboratory, Mare Island naval shipyard, revealed the gradual accumulation of many small deposits of mercury, primarily on the deck. This circumstance was caused by the spillage of mercury, used as a ballistic or a flotation medium in gyrocompasses, during the overhaul and repair of these instruments. Due to the fact that mercury is dispersed into innumerable, minute, free-running globules when poured or spilled, complete recovery from an open floor is impossible.

Preliminary investigations in August 1945 disclosed many large globules of mercury imbedded in small cracks and crevices of the porous concrete deck under the battleship linoleum flooring. This was a consequence of the linoleum flooring not having been thoroughly cemented to the concrete deck. As a result of these investigations, it was suspected that a condition potentially hazardous to the health of operating personnel existed, demanding a more intensive and detailed study.

In October 1945 the Industrial Health Service, Bureau of Adult Health, Department of Public Health, State of California, was

asked to take measurements of the mercury vapor concentration with a vapor detector. Measurements were made during normal operation with maximum window ventilation (I in table 1) as well as in the absence of any ventilation over a 2-day period (II in table 1). Readings were taken at floor level and at breathing level. The following results were obtained:

TABLE 1.—Mercury vapor concentration (mg. Hg/cu. meter air)

Location ¹	Windows open (I)				Windows closed (II)			
	Floor level		Breathing level		Floor level		Breathing level	
	Range	Average	Range	Average	Range	Average	Range	Average
A	0.10-0.40	0.27	0.00-0.10	0.05		0.38	0.20-0.27	0.22
B	.03-.16	.08	0.00-.03	.01			.14-.23	.19
C		.23		.00			.15-.19	.17
D	.16-.23	.21		.10			.14-.20	.16
E	.04-.14	.07	.02-.08	.04			.18-.23	.20
F							.14-.23	.19

¹ See figure 1.

The generally accepted maximum allowable concentration for mercury is 0.1 mg. per cubic meter of air (1) (2) (3). Although approximated values range from this figure to as high as 0.25 mg. per cubic meter of air (4) (5) (6) (7), some investigators believe a concentration as low as a few thousandths of a milligram of mercury per cubic meter of air is injurious on prolonged exposure (8).

In view of the above, the results obtained indicated that breathing level concentrations of mercury vapor with normal window ventilation were generally below and in no case greater than the probable safe concentration. However, floor level concentrations were nearly three times higher than the accepted maximum. Studies made after all windows had been kept closed for 2 days showed breathing level concentrations approximately twice as great as the safe limit in all parts of the room. Within 1 hour after the study had been completed and the windows opened, breathing level concentrations returned substantially to those obtained with maximum window ventilation.

Conclusions drawn from these results were as follows:

- (a) Mercurial deposits in the flooring were continually volatilizing.
- (b) Maximum window ventilation was able to dilute the mercury vapor concentration at the breathing level to and below the safe limit.
- (c) In the absence of window ventilation the resultant concentration of mercury vapor was excessively high.
- (d) During inclement weather, concentrations of mercury vapor causing dangerous exposure to operating personnel would be expected.¹

¹ During normal operation, windows bounding area B, C, D (fig. 1) are frequently secured to exclude the exhaust of corrosive gases, mists, and vapors from nearby plating operations.

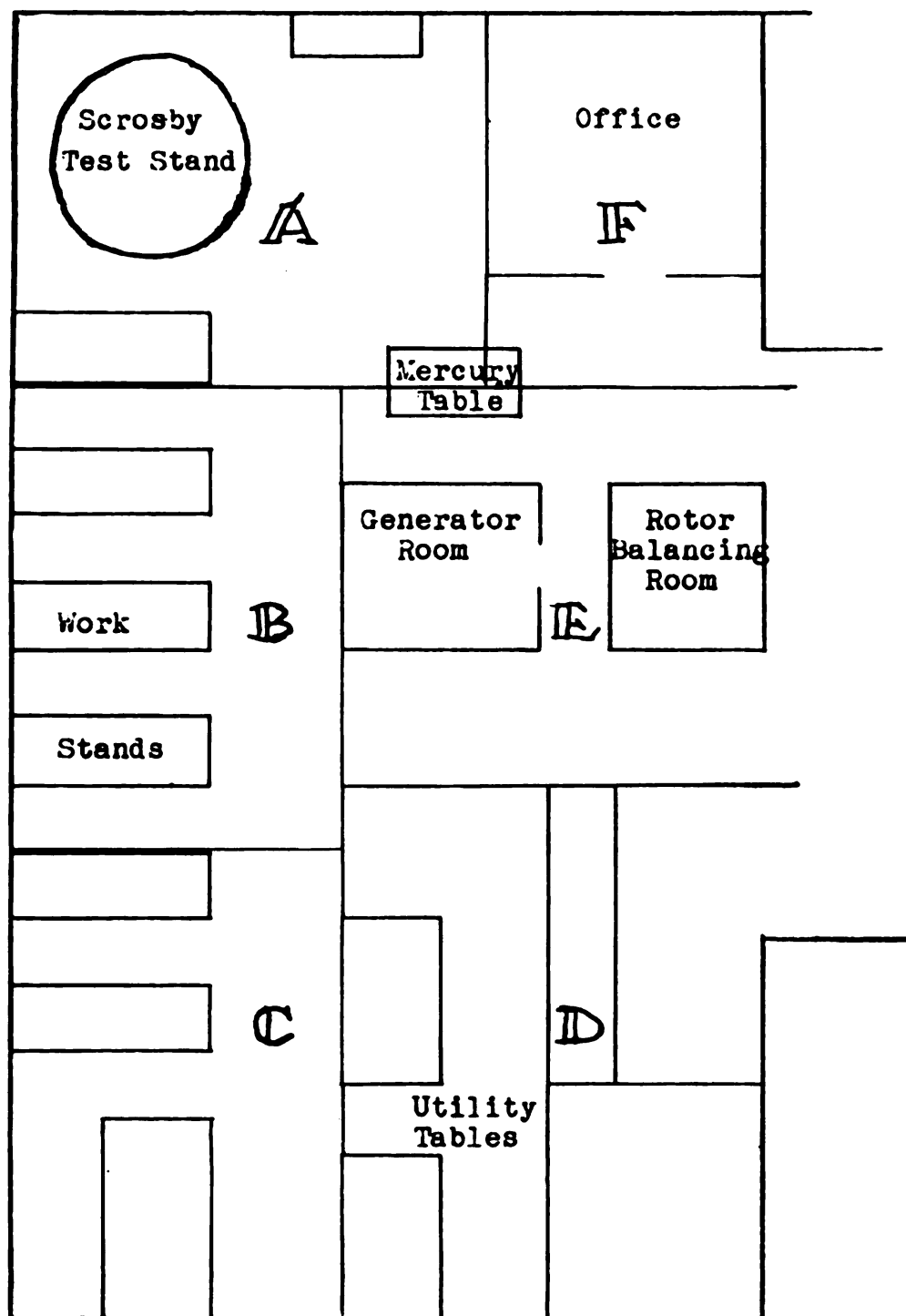


FIGURE 1.—Pre-survey diagram of gyro laboratory.

Tests performed by the Industrial Health Service showed that new linoleum in general, superficially abraded or worn linoleum in particular, absorbed sufficient mercury during a 12-hour contact followed by vacuum cleaning to discharge vapor in concentrations of 0.5 mg. per cubic meter of air. Eighteen hours after scrubbing with soap and water and drying, the concentration found with new linoleum was 0.02 mg. per cubic meter of air. After the same treatment and test period as above, abraded linoleum gave a concentration of 0.10 mg. per cubic meter of air. These findings were corroborated by analysis of used linoleum samples from the gyro laboratory deck.

In view of the results and conclusions drawn from this initial study the following recommendations were made:

(a) That the linoleum deck covering be taken up and completely discarded.

(b) That all deposits of liquid mercury found on the underlying concrete flooring be removed or inactivated.

(c) That adequate general ventilation be installed. (It was later decided that recommendation (c) be held in abeyance pending further study of the problem in order to determine the efficacy of recommendations (a) and (b)).

Following removal of the battleship linoleum and thoroughly cleaning the underlying concrete of all visible deposits of mercury by means of a vacuum cleaner, a restudy was made by the Industrial Health Service in January 1946.

The measurements of the restudy were made in the absence of any ventilation over a 2-day period, thereby being comparable to those of part II of the initial study. As in the first study, a vapor detector was used for all measurements. A comparison of the findings in part II of the initial study with those in the restudy are presented in table 2.

TABLE 2.—Mercury vapor concentration (mg. Hg/cu. meter air)

Location	Part II—Initial Study, October 1945				Restudy, January 1946			
	Floor level		Breathing level		Floor level		Breathing level	
	Range	Average	Range	Average	Range	Average	Range	Average
A		0.38	0.20-0.27	0.22	0.24-0.70	0.50	0.15-0.23	0.20
B			.14-.23	.19	.10-.60	.35	.07-.16	.10
C			.15-.19	.17	.45-.53	.49	.10-.21	.17
D			.14-.20	.16	.08-.76	.33	.11-.24	.18
E			.18-.23	.20	.0-.26	.11	.05-.20	.08
F			.14-.23	.19	.22-.58	.40		.15

The conclusions indicated by the results shown in table 2 were:

(a) That the installation of adequate general ventilation would be essential for control of this hazard in future normal operations.

(b) Removal of the linoleum flooring and an attempt to thoroughly clean the underlying concrete of deposits of liquid mercury did not alleviate the potentially hazardous condition.

(c) Countless small "reservoirs" of liquid mercury, discharging mercury vapor into the workroom atmosphere, remained imbedded in the small crevices, abraded spots, and surface of the concrete deck.

(d) Since no other practical means for the removal of these small "reservoirs" of mercury was available, it was felt that complete inactivation and sealing-in of these deposits was indicated.

As a consequence of the foregoing conclusions, the following recommendations were made:

(a) Installation of adequate general ventilation.

(b) Inactivation of the deposits of liquid mercury in the concrete floor.

(c) Application of a hard rubber-based paint over the treated floor to seal-in the inactivated mercury.

(d) Thoroughly cementing a hard-surfaced linoleum to the painted deck.

(e) Maintenance of this linoleum by frequent waxing with a preparation of ordinary floor wax containing some inactivating agent. This would serve as an aid in keeping vapor concentrations of mercury from unavoidable spillage at a safe level.

(f) Institution of spillage control measures to include: (1) Centralization of the weighing, filtering, and pouring of mercury over a screen-topped drainage table. (2) Use of metal floor trays under gyrocompass binnacles being overhauled and repaired. (3) Installation of a table-top drainage gutter around the edges of the work benches.

The above recommendations were carried out by:

(a) Installing a filtered air supply, floor-level exhaust ventilating system with a supply capacity of 8,500 cubic feet per minute. The total exhaust capacity of 9,000 cubic feet per minute is obtained through 11 grilles distributed around the periphery of the room, each grille having approximately 2 square feet of effective exhaust area. Velometer readings of these grilles gave the following average characteristics for each grille:

Velocity range, 250 to 600 feet per minute.

Average velocity, 400 feet per minute.

Average volume, 800 cubic feet per minute.

(b) Inactivation of mercury deposits by means of a process employing a calcium polysulfide wash (9). The principles involved are the conversion of metallic mercury into mercuric sulfide on contact as well as enclosing the minute globules of metallic mercury in a rela-

tively nonvolatile envelope, thereby retarding the rate of evaporation of the mercury.

(c) Application of a chlorinated rubber lacquer over the inactivated mercury.

(d) Impregnating an ordinary deck wax (liquid or paste) with 3 to 5 percent of flowers of sulphur.

(e) Recommendations (d) and (f) listed above were carried out as recommended.

In October 1946, approximately 3 months after the completion of the above listed installations and other remedial measures, the Industrial Health Service was requested to remeasure the mercury vapor concentrations. During the interval between completion of installations and remeasurement, normal operating conditions prevailed. The results of these measurements are presented in table 3.

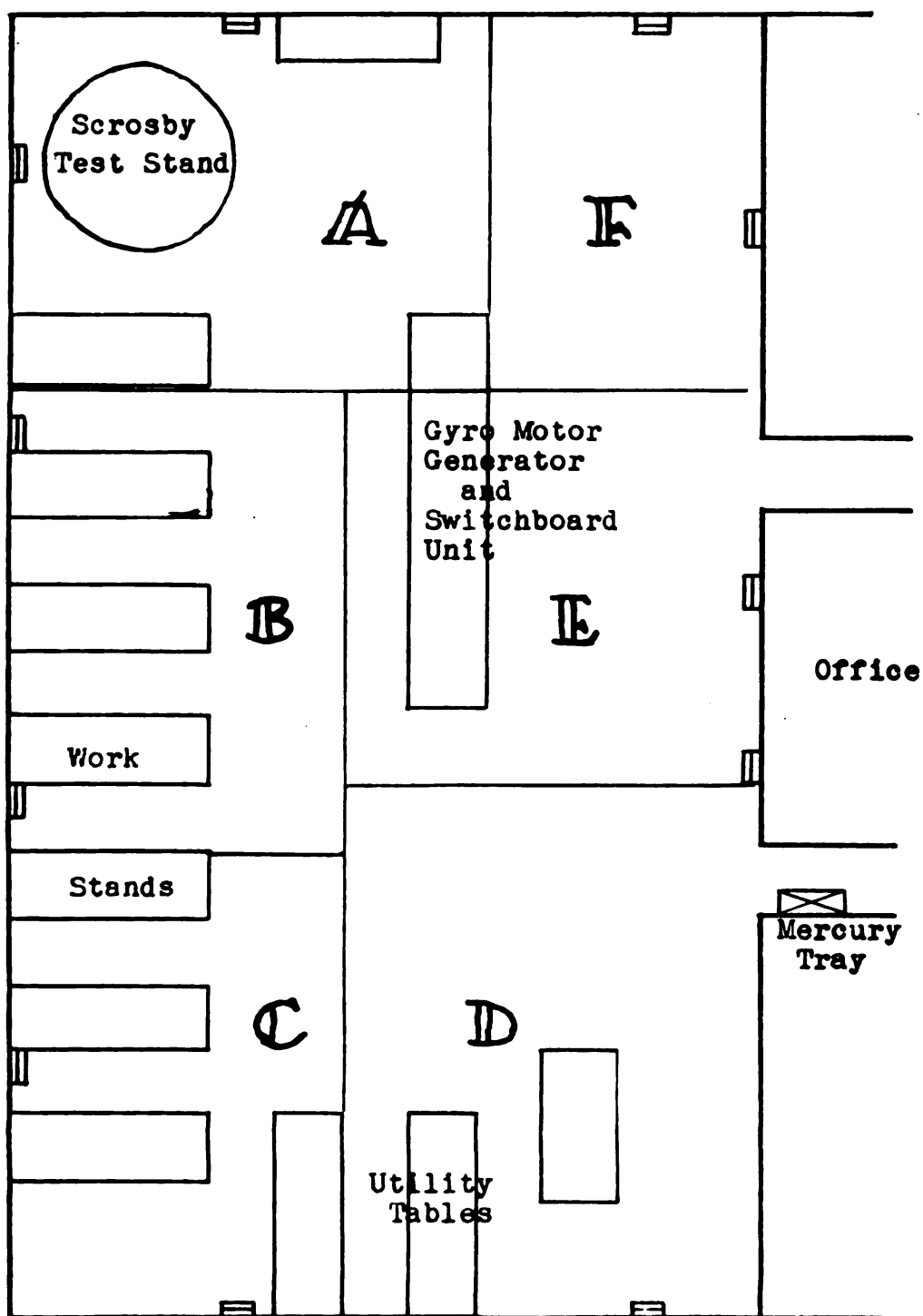
TABLE 3.—Mercury vapor concentration (mg. Hg/cu. meter air)

Location	Floor level		Breathing level	
	Range	Average	Range	Average
A	0.00-0.06	0.03	0.00-0.02	0.01
B	.00-.12	.06	.00-.05	.03
C	.0-0	.00	.0-0	0
D				
E	.04	.04	.01	.01
F	.03	.03	.03	.03
Average		.03		.02

TABLE 4.—Mercury vapor concentration (mg. Hg/cu. meter air)

Location	Floor level (average)			Breathing level (average)		
	Initial (I) October 1945	Linoleum removed January 1946	Final October 1946	Initial (II) October 1945	Linoleum removed January 1946	Final October 1946
A	0.27	0.50	0.03	0.22	0.20	0.01
B	.08	.35	.06	.19	.10	.03
C	.23	.49	.00	.17	.17	.00
D	.21	.33		.16	.18	
E	.07	.11	.04	.20	.08	.01
F		.40	.03	.19	.15	.03
Average	.17	.36	.03	.19	.15	.02

As in the previous studies, a mercury vapor detector was used. These results indicated that the source of high mercury vapor concentrations had been controlled to a considerable extent. It was also indicated that the forced draft ventilation was capable of removing enough of the mercury vapor arising from the small uncontrollable source that the concentrations were reduced in all parts of the room to a level well within the generally accepted maximum allowable limit. The effectiveness of the recommended installations and treatments as a



≡ Floor level exhaust grilles

FIGURE 2.—Post-survey diagram of gyro laboratory.

whole in reducing both the breathing level and floor level concentrations of mercury vapor can be more readily shown by comparisons in table 4.

Conclusions drawn from the results and comparisons in table 4 are:

(a) That the recommended treatments and installations have been successful in alleviating the originally unsatisfactory condition existing in the gyro laboratory.

(b) That proper maintenance and "housekeeping" will keep the mercury vapor concentration at the low level to which it has been reduced.

(c) That semiannual surveys will be necessary to determine the effectiveness of the maintenance and "housekeeping" effort.

The number of employees who had worked in the gyro laboratory during the time of estimated exposure varied from 24 to 45. About half of these men had no doubt been exposed to potentially dangerous concentrations of mercury vapor for periods up to 18 or 20 months.

Rigid medical supervision, as promulgated in SecNav's ltr SOSED-2-EGM 1602 SO 625504 of 4 July 1942, was carried out from August 1945. At no time was there any evidence, clinical or laboratory, of mercurialism in any of the personnel under surveillance.

The writers wish to express their gratitude for the splendid co-operation and services rendered by the staff of the Industrial Health Service, Bureau of Adult Health, Department of Public Health, State of California.

REFERENCES

1. BOWDITCH, M., and others: Code for safe concentrations of certain common toxic substances used in industry. *J. Indust. Hyg. Toxicol.* **22**: 251, June 1940.
2. American Standards Association, New York: Allowable Concentrations of Mercury. Z37.8-1943.
3. COOK, W. A.: Maximum allowable concentrations of industrial atmospheric contaminants. *Indust. Med.* **14**: 936-946, Nov. 1945.
4. State of Calif., Dept. of Industrial Relations, Min. Industrial Accident Comm., Nov. 1939.
5. State of Connecticut, Sanitary Code, Regulation 281, 1936.
6. State of Illinois, Labor Dept. (Proposed) 1940.
7. Dalla Valle, U. S. Pub. Health Service: Principles of Exhaust Hood Design. 1939.
8. Stock and Cucuel, *Ber.* **67B**, 122, 1934.
9. RANDALL, M., and HUMPHREY, H. B.: New Process for Controlling Mercury Vapor. U. S. Bureau of Mines. Information Circular No. 7206, April 1942.



NOTES ON CONTRIBUTORS

Britten, Sidney A., Commander (MC) USN (*Pulmonary Tuberculosis: A Review of Sixty-Six Cases With Anatomical Findings*, p. 132). A. B., Hamilton College, 1927; M. D., Syracuse University College of Medicine, 1931. Intern, Hospital of the Good Shepherd, Syracuse University, Syracuse, N. Y., 1931-32; Trudeau School of Tuberculosis, 1933; instructor in medicine, Syracuse University College of Medicine, 1934-41; assistant in medicine, Hospital of the Good Shepherd, Syracuse University, 1934-41; physician, tuberculosis clinic, Health Department, City of Syracuse, 1935-41; attending physician, General Hospital, Syracuse, 1936-41; private practice, internal medicine and diseases of the chest, Syracuse, 1933-41. Appointed passed assistant surgeon, USNR, 20 Mar. 1941 from New York; transferred to Regular Navy 5 Sept. 1946. Specialty: Internal medicine and diseases of the lung. Served at U. S. Naval Submarine Base, New London, Conn.; U. S. Naval Training Station, Noroton Heights, Conn.; and Bureau of Medicine and Surgery, Navy Dept., Washington, D. C. Member: American Medical Association, American Trudeau Society, American Public Health Association, American College of Chest Physicians, and Syracuse Academy of Medicine.

Brown, Harry J., Lieutenant (MC) USN (*Radiographic Study of Fractures of the Carpal Navicular Bone*, p. 66). A. B., University of Kansas, 1938; M. D., University of Kansas School of Medicine, 1943. Intern, U. S. Naval Hospital, Treasure Island, Calif. Appointed ensign, H-V(P), USNR, 22 May 1942 from Kansas; classification changed to acting assistant surgeon, USN, 27 May 1943. Served on U. S. S. *Putnam* and at U. S. Naval Hospital, Great Lakes, Ill. Resigned 31 Jan. 1947.

Brown, Robert B., Commander (MC) USN (*Bronchogenic Cysts of the Mediastinum*, p. 107; *Liver Abscess*, p. 7). B. S., Allegheny College, 1929; M. D., University of Pennsylvania School of Medicine, 1933; D. Sc. in Medicine, The Medico-Chirurgical College, Graduate School of Medicine, University of Pennsylvania, 1941. Intern, Hospital of the University of Pennsylvania, Philadelphia, Pa., 1933-35; fellow in surgery, 1935-41, assistant instructor in surgery, 1935-36, instructor in surgery, 1936-47, and associate in surgery, 1947-, University of Pennsylvania School of Medicine; assistant in surgery, Philadelphia General Hospital, Presbyterian Hospital, and Doctors Hospital, all of Philadelphia, Pa., 1941-46. Appointed passed assistant surgeon, USNR, 3 Jan. 1939 from Pennsylvania; transferred to Regular Navy 3 Jan. 1947. Specialty: Surgery. Served at U. S. Naval Hospital, Annapolis, Md., and U. S. Naval Hospital, Philadelphia, Pa., and on U. S. S. *Tranquillity* and U. S. S. *Solace*. Fellow: American College of Surgeons; member: American Medical Association, Medical Society of the State of Pennsylvania, Philadelphia County Medical Society, and Society of University Surgeons. Diplomate: American Board of Surgery.

Byron, Ralph L., Jr., Lieutenant, junior grade (MC) USNR (Inactive) (*Cotton Knots*, p. 93). A. B., University of California, 1935; M. D., University of

California Medical School, 1940. Intern, Los Angeles County General Hospital, Los Angeles, Calif., July 1939-June 1941; assistant resident in surgery, University of California Hospital, June 1941-July 1942; research assistant, University of California (Berkeley), July 1942-Sept. 1943; assistant resident in surgery, University of California Hospital, Sept. 1943-June 1944. Appointed assistant surgeon, USNR, 10 Nov. 1943, from California. Served at U. S. Naval Hospital, Treasure Island, San Francisco, Calif., and with 3d Corps Medical Battalion, Fleet Marines, San Francisco, Calif. Released from active duty 3 June 1946. Senior house officer in surgery, San Francisco City and County Hospital, San Francisco, Calif., Sept. 1946-Sept. 1947; resident in surgery, University of California Service, San Francisco City and County Hospital, Sept. 1947-.

Carson, Leon D., Captain (MC) USN (*The Naval Station Dispensary*, p. 76). M. D., Northwestern University Medical School, 1925. Appointed assistant surgeon, USN, 20 June 1924 from Illinois; resigned 31 July 1925; appointed assistant surgeon, USNR, 19 Dec. 1925; transferred to Regular Navy 17 Feb. 1926. Specialty: Aviation medicine. Served with Air Evacuation Medical Unit VRE-1, Pacific theatre during evacuation of combat casualties during operations at Iwo Jima and Okinawa; and Medical Research Section, Flight Division, Bureau of Aeronautics. Fellow: Aero-Medical Association; associate fellow: American College of Physicians; honorary fellow: Puget Sound Academy of Ophthalmology and Otolaryngology; member: American Medical Association.

Cooper, Henry R., Lieutenant (MC) USN (*Tularemia*, p. 102). M. D., University of Tennessee College of Medicine, 1943. Intern, U. S. Naval Hospital, Charleston, S. C., 22 Apr. 1943-1 Feb. 1944. Appointed ensign, H-V(P) USNR, 15 May 1942; classification changed to acting assistant surgeon, USN, 21 Apr. 1943. Served on Atlantic convoy duty and with 29th Special Construction Battalion in Pacific theatre. Resident in internal medicine, at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

Deas, Thomas C., Lieutenant, junior grade (MC) USN (*Epidermolysis Bullosa Hereditaria*, p. 112). B. S., University of Georgia, 1942; M. D., University of Georgia School of Medicine, 1945. Appointed ensign, H-V(P), USNR, Jan. 1943 from Georgia; resigned and enlisted as apprentice seaman, V-12(S), USNR, July 1943; appointed assistant surgeon, USNR, June 1945. Intern, U. S. Naval Hospital, Parris Island, S. C., 1945-46. Served at U. S. Naval Hospital, Parris Island, S. C., 1946, and at the Post Dispensary, Medical Detachment, U. S. Marine Corps Recruit Depot, Parris Island, S. C., 1947. Fellow: American Medical Association.

Delaney, Adrian J., Captain (MC) USN (*The Modern Treatment of Progressive Deafness*, p. 1). A. B., Columbia University, 1928; M. D., Georgetown University School of Medicine, 1931. Appointed assistant surgeon, USN, 26 June 1931. Specialty: Diseases of eye, ear, nose and throat. Intern, U. S. Naval Hospital, Washington, D. C., 1931-33; resident, Illinois Eye and Ear Infirmary, Chicago, Ill., 1939-40; post-graduate course in endaural surgery of temporal bone, Lempert Endaural Institute, New York, 1946. Served as chief, eye, ear, nose and throat service on U. S. S. *Relief* and U. S. S. *Boston*; and at U. S. Naval Hospital, Parris Island, S. C., and U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Fellow: American Medical Association; member: American Academy of Ophthalmology and Otolaryngology. Diplomate: American Board of Otolaryngology.

Elburn, Maynard K., Lieutenant (DC) USNR (Inactive) (*The Use of Penicillin in Dental Infections*, p. 120). A. B., Brooklyn College, 1939; D. D. S., New York University College of Dentistry, 1943. Appointed ensign, H-V(P), USNR, 13 Jan. 1942 from New York; classification changed to lieutenant, junior grade (DC) USNR, 2 July 1943. Served at U. S. Naval Operating Base, Adak, Alaska, and U. S. Naval Personnel Separation Center, Seattle, Wash. Released from active duty Sept. 1946.

Enyart, John L., Captain (MC) USN (*Radiographic Study of Fractures of the Carpal Navicular Bone*, p. 66). A. B., University of Missouri, 1923; M. D., Northwestern University Medical School, 1926. Intern St. Elizabeths Hospital, Washington, D. C., June 1926-June 1927. Served in the U. S. Navy, 8 Aug. 1918-18 Feb. 1919; appointed assistant surgeon, USN, 26 June 1927. Specialty: General surgery. Served at U. S. Naval Mobile Hospital No. 13; with U. S. Naval Forces in Europe; and at U. S. Naval Hospital, Philadelphia, Pa., and U. S. Naval Hospital, Great Lakes, Ill. Fellow: American Medical Association.

Fischbach, William M., Lieutenant (MC) USNR (Inactive) (*Cardiac and Electrocardiographic Observations on American Prisoners of War Repatriated from Japan*, p. 69). A. B., University of Cincinnati, 1934; M. D., University of Cincinnati College of Medicine, 1937. Intern, 1937-38, and assistant resident in internal medicine, 1938-39, Cincinnati General Hospital, Cincinnati, Ohio; assistant clinician, 1939-43, and clinician, 1943-, medical service, outpatient dispensary, University of Cincinnati, Cincinnati General Hospital; attending staff, Bethesda Hospital, Cincinnati, Ohio. Appointed assistant surgeon, USNR, 11 Mar. 1943 from Ohio. Served at U. S. Naval Aviation Training Center, Corpus Christi, Tex.; U. S. Naval Shore Facility, Leyte, P. I.; and U. S. Naval Hospital, Seattle, Wash. Released from active duty 3 Apr. 1946. Fellow: American Medical Association; member: Ohio State Medical Association, Academy of Medicine of Cincinnati, and Cincinnati Heart Council.

Fox, Joseph Robert, Lieutenant, junior grade (MC) USNR (Inactive) (*Chemical Burn of the Esophagus*, p. 118). A. B., Princeton University, 1939; M. D., Jefferson Medical College of Philadelphia, 1943. Intern, 1 Apr. 1943-31 Dec. 1943, and resident Jan. 1944-July 1945, Jefferson Medical College Hospital, Philadelphia, Pa. Appointed ensign, H-V(S), USNR, 19 May 1942; classification changed to assistant surgeon 18 Mar. 1943. Served at U. S. Naval Hospital, Philadelphia, Pa. Released from active duty 23 Aug. 1946. Member: Philadelphia Medical Society. Diplomate: American Board Otolaryngology.

Godfrey, Ellwood W., Commander (MC) USNR (Inactive) (*Liver Abscess*, p. 7). M. D., University of Pennsylvania School of Medicine, 1937. Intern, Bryn Mawr Hospital, Bryn Mawr, Pa., 1938; fellow in radiology, Hospital of the University of Pennsylvania, 1938-41; associate instructor in radiology, 1938-41, and instructor, 1941, The Medico-Chirurgical College Graduate School of Medicine, University of Pennsylvania. Appointed assistant surgeon, USNR, 9 Feb. 1939. Specialty: Radiology. Served on U. S. S. *Solace*; at U. S. Naval Hospital, Quantico, Va., and U. S. Naval Hospital, Philadelphia, Pa. Released from active duty 27 Mar. 1946. Now on staff, Hartford Hospital, Newington Home for Crippled Children, Institute for Living, Hartford, Conn. Member: American Medical Association, American College of Radiology, and Radiologic Society of North America. Diplomate: American Board of Radiology.

Golden, Howard, M. D. (*Hepatic Amebiasis*, p. 22). B. S., University of South Carolina, 1935; M. D., University of Lausanne, Switzerland, 1941. Intern, Fordham Hospital, Bronx, N. Y., July 1941–July 1942. Appointed captain, M. C., Army, U. S., 22 Feb. 1944 from Minnesota. Specialty, Internal medicine, gastro-enterology. Served at Veterans' Hospital, Dearborn, Mich. Separated from the service 15 Aug. 1946. Fellow: American Medical Association; member: Medical Society of the State of New York and Onondaga County Medical Society; associate member: Detroit Gastro-enterological Society.

Hays, Thomas G., Captain (MC) USN (*Liver Abscess*, p. 7). M. D., University of Illinois College of Medicine, 1928. Postgraduate work in surgery. The Medico-Chirurgical College, Graduate School of Medicine, University of Pennsylvania, 1936–37. Appointed assistant surgeon, USN, 5 June 1928. Specialty: Surgery. Executive officer and chief of surgery, U. S. Naval Hospital, Annapolis, Md., 1945; chief of surgery, U. S. Naval Hospital, Philadelphia, Pa., 1945–46. Fellow: American College of Surgeons.

Huebsch, Raymond F., Commander (DC) USN (*Surgical Removal of an Odontoma and Impacted Anterior Teeth*, p. 116). B. S., University of Southern California; D. D. S., School of Dentistry, University of Southern California, 1941. Postgraduate course in maxillofacial, plastic, and oral surgery, Mayo Foundation, Rochester, Minn. Appointed lieutenant, junior grade (DC) USN, 8 Sept. 1941 from California. Specialty: Oral surgery. Served at U. S. Naval Mobile Hospital No. 2, U. S. Naval Training Station, Farragut, Idaho, and U. S. Naval Hospital, Alca Heights, T. H. Member: American Dental Association.

Jackson, Frank A., Lieutenant, H(S) USNR (Inactive) (*Potential Mercury Vapor Hazard in a Gyro Laboratory*, p. 139). B. A., Whitman College, 1938. Chemist, I. F. Laucks, Seattle, Wash., May 1939–May 1940, and Blue Mountain Canneries, Inc., Dayton, Wash. Appointed ensign, H–V(S), USNR, 26 Nov. 1941. Served at U. S. Navy Yard, Pearl Harbor, T. H., and U. S. Navy Yard, Mare Island, Calif. Released from active duty 28 Feb. 1946.

Jeffers, Clark P., Commander (MC) USN (*Potential Mercury Vapor Hazard in a Gyro Laboratory*, p. 139). B. S., University of Nebraska, 1932; M. D., University of Nebraska College of Medicine, 1932. Intern, Bishop Clarkson Memorial Hospital, Omaha, Neb., 12 months, and Providence Hospital, Seattle, Wash., 6 months; attending staff, General Hospital, Eureka, Calif., 1934–35, and St. Joseph Hospital, Eureka, Calif., Jan. 1935–Jan. 1936. Served as first lieutenant, Medical Corps Reserves, U. S. Army, 13 May 1934 to 4 Jan. 1937. Appointed assistant surgeon, USN, 4 Jan. 1937. Served on U. S. S. *General A. E. Anderson*; at U. S. Navy Yard, Mare Island, Calif.; and with Pacific Fleet. Fellow: American Medical Association.

Johnston, William C. B., Commander (MC) USNR (Inactive) (*A Study of 200 Violators of General Court Martial Probation*, p. 81). M. B., University of Toronto Faculty of Medicine, 1925. Intern, Highland Hospital, Rochester, N. Y., 1925–26; assistant physician, Foord Sanitarium, Kerhonkson, N. Y., 1926–33; prison physician, Wallkill State Prison, Wallkill, N. Y., 1933–40; assistant physician, Matteawan State Hospital, Beacon, N. Y., 1940–. Appointed surgeon, USNR, 28 Oct. 1943 from New York. Specialty: Psychiatry, neurology. Served at U. S. Naval Receiving Station, U. S. Naval Operating Base, Norfolk, Va. Released from active duty 24 Apr. 1946. Now supervising psychiatrist, Matteawan State Hospital. Member: Medical Society of the State of New York and Dutchess County Medical Society.

Kullman, Harold J. F., Captain (MC) USNR (Inactive) (*Hepatic Amebiasis*, p. 22). M. D., Wayne University College of Medicine, 1927. Intern, City of Detroit Receiving Hospital, Detroit, Mich., July 1926–July 1927; fellow, internal medicine, Mayo Foundation, Rochester, Minn., Oct. 1928–Apr. 1932; attending physician, Wayne General Hospital, Wayne, Mich., 1935–42; associate attending physician, City of Detroit Receiving Hospital, Detroit, Mich., 1936–; assistant professor of clinical medicine, Wayne University College of Medicine, 1945–. Appointed surgeon, USNR, 13 Feb. 1942, from Michigan. Specialty: Internal medicine. Served at U. S. Naval Hospital, Memphis, Tenn., and with U. S. Fleet Hospital No. 115, Guam, Marianas Islands. Released from active duty 16 Feb. 1946. Now chief of Medical Service, Veterans' Administration Hospital, Dearborn, Mich. Fellow: American College of Physicians; member: Wayne County Medical Society, Michigan State Medical Society, and American Gastroscopic Society. Diplomate: American Board of Internal Medicine.

Lowe, Edward S., Captain (MC) USN (*Decortication of the Lung in Organizing Hemothorax and Empyema*, p. 52). M. D., University of Colorado School of Medicine, 1929. Intern, Colorado Psychopathic Hospital, Denver, Colo., June 1928–June 1929; U. S. Naval Hospital, San Diego, Calif., July 1929–Aug. 1930. Appointed assistant surgeon, USN, 26 June 1929. Specialty: Surgery and pathology. Served at U. S. Naval Hospital, San Diego, Calif., U. S. Navy Convalescent Hospital, Asheville, N. C., U. S. Naval Hospital, Philadelphia, Pa., U. S. Naval Hospital, Long Beach, Calif., U. S. Naval Hospital, Canacao, P. I., and U. S. Naval Hospital, Aiea Heights, T. H.; and on U. S. S. *San Francisco*, U. S. S. *Idaho*, U. S. S. *Henderson*, and U. S. S. *Palos*. Fellow: American College of Surgeons and American Medical Association.

Morton, Paul H., Commander (MC) USN (*Epidermolysis Bullosa Hereditaria*, p. 112). B. A., University of Utah, 1934; M. D., Jefferson Medical College of Philadelphia, 1938. Intern, U. S. Naval Hospital, San Diego, Calif., 1938–39. Appointed acting assistant surgeon, USN, 18 July 1938 from Utah. Specialty: Internal medicine and aviation medicine. Served with Air Force, Atlantic Fleet, 1942–45, in North Atlantic and European theatre; and at U. S. Naval Hospital, Parris Island, S. C. Fellow: American College of Physicians; member: Aero-Medical Association and American Medical Association. Diplomate: American Board of Internal Medicine.

Otness, H. Robert, Lieutenant Commander H(S) USNR (Inactive) (*A Study of 200 Violators of General Court Martial Probation*, p. 81). A. B. and M. S., University of Idaho, 1932; Ph. D., New York University, 1939. Psychologist, New York State Training School for Boys, Warwick, N. Y., 1938–39; chief clinician, Training School, Vineland, N. J., 1939–43. Appointed lieutenant, junior grade, H–V(S) USNR, 17 Dec. 1942. Served at U. S. Naval Receiving Station, U. S. Naval Operating Base, Norfolk, Va., and U. S. Naval Station, Farragut, Idaho. Released from active duty 9 Aug. 1946. Member: American Psychological Association, American Association for the Advancement of Science, American Association on Mental Deficiency, New Jersey Association of Psychologists, Association for the Advancement of Psychotherapy, and International Council on Exceptional Children.

Pereyra, Armand J., Captain (MC) USN (*Ion Transfer of Penicillin*, p. 40). A. B., University of California, 1926; M. D., University of California Medical School, 1930. Instructor in topographical anatomy and assistant in research, Department of Anatomy, University of California Medical School, 1928. Appointed assistant surgeon, USN, 15 July 1930 from California. Specialty:

Obstetrics and Gynecology. Assigned to research on electrophoresis methods with U. S. Public Health Service at U. S. Marine Hospital, Staten Island, N. Y., 1942. Served at U. S. Naval Hospital, Portsmouth, Va.; with Fleet Hospital No. 115, Fleet Hospital No. 114, Pacific Fleet, Asiatic Fleet, Atlantic Fleet, and Seventh Fleet. Fellow: American College of Surgeons; member: Advisory Council of the Association for Advancement of Research on Iontophoresis and New York Academy of Sciences.

Rosati, Guido J., Lieutenant, H(S) USNR (Inactive) (*Potential Mercury Vapor Hazard in a Gyro Laboratory*, p. 139). B. S., College of Chemistry, University of California, 1941. Post graduate industrial hygiene, De Lamar Institute of Public Health, Columbia University, 1942. Served at U. S. Naval Torpedo Station, Keyport, Wash., U. S. Navy Shipyard, Philadelphia, Pa., and U. S. Navy Shipyard, Mare Island, Vallejo, Calif. Released from active duty 28 June 1946.

Schuster, Boris, Commander (MC) USN (*Therapy of Throat Infections with Bismuth vs. Penicillin*, p. 61). M. D., Rush Medical College, 1937. Appointed acting assistant surgeon, USN, 17 July 1937. Served at U. S. Naval Air Station, Seattle, Wash., and U. S. Naval Air Station, Sitka, Alaska; and on U. S. S. *Tuscaloosa*. Resigned 12 Oct. 1946.

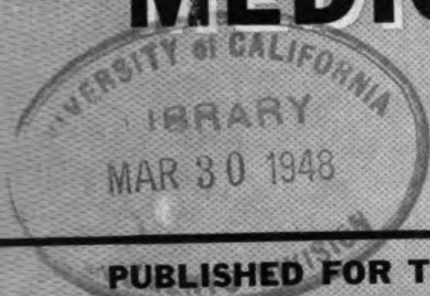
Swanson, Clifford A., Rear Admiral (MC) USN (*The Modern Treatment of Progressive Deafness*, p. 1). B. S., Northern State Teachers College, 1921; M. D., University of Michigan Medical School, 1925. Appointed assistant surgeon, USN, 15 June 1925. Specialty: Diseases of the eye, ear, nose and throat. Served on U. S. S. *Iowa*; at the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md., and U. S. Naval Dispensary, Navy Department, Washington, D. C.; was designated as a medical officer to accompany the Congressional Committee making an inspection of the Pacific war area; appointed Surgeon General, U. S. Navy, and Chief of the Bureau of Medicine and Surgery, Navy Department, 1 Dec. 1946. Fellow: American College of Surgeons and American Academy of Ophthalmology and Otolaryngology; member: American Medical Association. Diplomate: American Board of Ophthalmology and American Board of Otolaryngology.

Taylor, Ralph W., Captain (DC) USN (*Surgical Removal of an Odontoma and Impacted Anterior Teeth*, p. 116). D. D. S., College of Dentistry, University of Southern California, 1924. Clinical instructor, University of Southern California, Sept. 1926-July 1928. Appointed lieutenant, junior grade, USN, 2 July 1928, from California. Specialty: Oral surgery. Served at U. S. Naval Dental School, National Naval Medical Center, Bethesda, Md., and U. S. Naval Hospital, Pearl Harbor, T. H. Fellow: American College of Dentists; member: American Dental Association, American Society of Oral Surgeons, and International Association for Dental Research.

Trunnell, Jack B., Lieutenant, junior grade (MC) USNR (*Radiographic Study of Fractures of the Carpal Navicular Bone*, p. 66). A. B., Brigham Young University, 1942; M. D., University of Utah School of Medicine, 1945. Appointed ensign, H-V(S), USNR, 16 July 1942; classification changed to apprentice seaman, G-12, USNR, 5 May 1943; appointed assistant surgeon, USNR, 5 June 1945. Served at U. S. Naval Hospital, Great Lakes, Ill. Assistant resident in medicine, Memorial Hospital and research fellow, Sloan Kettering Institute for Cancer Research, New York, N. Y., July 1946.

11
55

UNITED STATES NAVAL MEDICAL BULLETIN



PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

4E 48

NUMBER 2



MARCH-APRIL 1948

Bimonthly

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED P-112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

Naval dentistry in the Pacific during World War II. This particular dental office was in a Quonset hut in Munda.

—Official U. S. Navy Photo.

Vol. 48

MARCH-APRIL 1948

NO. 2

UNITED STATES NAVAL MEDICAL BULLETIN

**THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**



BIMONTHLY

**DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY**

Compiled and published under the authority of
Naval Appropriations Act for fiscal year 1948,
Public Law No. 202, approved July 18, 1947

**UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1948**

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page ii for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.



Because the supply of certain numbers of the **BULLETIN** is exhausted and because of the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated :

All numbers up to and including 1921.

Volume 16, 1922, No. 5.

Volume 17, 1922, No. 4.

Volume 18, 1923, Nos. 1, 3, and 5.

Volume 19, 1923, No. 3.

Volume 20, 1924, No. 5.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, No. 1.

Volume 26, 1928, Nos. 1 and 3.

Volume 31, 1933, No. 3.

Volume 42, 1944, Nos. 2 and 6.

Volume 44, 1945, No. 6.

March 1946 Supplement.

Volume 47, 1947, No. 6.



SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$1.75; foreign subscription, \$2.25.

Single number, 35 cents.

Exchange of publications will be extended to medical and scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE



The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

CLIFFORD A. SWANSON,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS



Contributions to the **BULLETIN** should be typewritten, double-spaced, on plain paper of standard letter size and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions and the style laid down in the Government Printing Office Style Manual for spelling, abbreviations, capitalization, and the use of figures.

All pictures should be unmounted, if possible. Photographs should be glossy prints and charts and drawings made with black india ink.

Contributions are to be the original work of the author and great care should be exercised to enclose in quotation marks quotations which may be introduced. Full credit for the source for these quotations should also be given. Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the **BULLETIN** should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*

Captain, Medical Corps,

United States Navy.

HILTON W. ROSE, *Assistant Editor,*

Captain, Medical Corps,

United States Navy.

TABLE OF CONTENTS



	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Diseases of Leading Importance to the Navy — <i>Robert L. Ware</i>	153
Intramedullary Fixation of Fractures of the Femur — <i>Howell E. Wiggins and Gwilym B. Lewis</i>	161
Specific Therapy in Osteomyelitis — <i>John W. Metcalfe</i>	175
Hodgkin's Disease — <i>James T. Smith, Joseph R. Connelly, and Joseph M. Straughan</i>	180
Anesthesia Activities Aboard U. S. S. "Benevolence" — <i>David G. Clark</i> ...	190
A Review of Present Methods in the Early Diagnosis of Bronchogenic Carcinoma — <i>Harvey E. Reitz</i>	198
Aphorisms on Peptic Ulcer Seen in the Naval Service — <i>Lewis Gunther</i>	207
The Use of Plasma in the Treatment of Combat Fatigue — <i>Philip Solomon</i> ..	226
Interesting Notes on Bipartite Patellae — <i>John J. Callahan</i>	229
A Study of the Effect of Breathing Oxygen or Normal Air After Exposure to an Atmosphere Having a High Concentration of Carbon Dioxide — <i>Robert Hayter and Gerald J. Duffner</i>	234
A Dysentery Outbreak Aboard a Cruiser in Apra Harbor, Guam, Marianas Islands — <i>Robert A. Mount and Thomas M. Floyd</i>	240
Treatment of Acute Sacrococcygeal Cyst Teratoma — <i>Jesse F. Adams</i>	250
Hemorrhage Associated With Gastritis; Review of the Literature and Report of Two Cases — <i>Irvin Lewis Chipman, Jr.</i>	253
General Information Regarding Tropical Hygiene and Living in the Tropics ..	258

EDITORIALS

Results of Questionnaire in November-December Issue of the U. S. Naval Medical Bulletin	263
Granuloma Inguinale and Lymphogranuloma Venereum	265
Epidemic Diarrhea of the Newborn	266

	Page
Where is the Appendix?.....	266
Conservative Treatment of Placenta Previa.....	267
The Medical History of the Navy—World War II.....	268
The Treatment of Yellow Fever.....	269
The Wellcome Prize in 1947.....	269
Examinations by the American Board of Ophthalmology.....	270
 NOTICES OF DEATHS IN MEDICAL AND DENTAL CORPS.....	 271

CLINICAL NOTES

Hodgkin's Disease Involving the Epicardium; Report of a Case— <i>James J. McCoy, Jr.</i>	272
Metastatic Tumor in the Heart; Report of a Case— <i>Winston Braun and George Towle Hoffmann</i>	275
Fixation of Mandibular Fractures With Report of Three Cases— <i>Walter W. Crowe</i>	278
Acute Disseminated Lupus Erythematosus With Fatal Termination— <i>Robert K. Moxon</i>	286
A Case of Migraine With Lesion Localized in the Visual Tract— <i>William L. Berkley and Robert D. Gilliam</i>	290
Ganglioneuroma; Report of a Case of Intrathoracic Ganglioneuroma— <i>Vincent L. Barker and Henry J. Caes</i>	298
Fatal Anaphylaxis Following Typhus Vaccine Injection— <i>Russell H. Walker</i>	303
Salmonella Osteomyelitis; Report of a Case With <i>Salmonella schottmülleri</i> as the Etiologic Agent— <i>Robert C. Abrams and Frederick G. Gaenslen</i>	306

MEDICAL AND SURGICAL DEVICES

A Modification of an Oral Photographic Apparatus Originally Constructed by the Dental School, University of Pennsylvania— <i>Carl A. Schlack</i>	312
--------------------------------------------------------------------------------------------------------------------------------------------------------	-----

BOOK NOTICES

Textbook of General Surgery, <i>Cole and Elman</i> —History of Medicine, <i>Mettler</i> ; edited by <i>Mettler</i> —The 1946 Year Book of Endocrinology, Metabolism, and Nutrition, edited by <i>Thompson and Spies</i> —Diseases of the Skin, <i>Sequeira, Ingram, and Brain</i> —The Selected Writings of Benjamin Rush, edited by <i>Runes</i> —Fundamentals of Clinical Neurology, <i>Merritt, Mettler, and Putnam</i> —A Handbook of Commonly Used Drugs, <i>Pijoan and Yeager</i> —Oral Surgery, <i>Mead</i> —Diagnosis in Daily Practice, <i>White and Geschickter</i> —Practical Anesthesia for Dental and Oral Surgery,

TABLE OF CONTENTS

VII

	Page
<i>Seldin—Practical Physiological Chemistry, Hawk, Oser, and Summer- son—Nursing Care in Chronic Diseases, Marsh—Therapeutic Exercise, Everhardt and Riddle—Applied Anatomy of the Head and Neck, Shapiro.</i>	319

PREVENTIVE MEDICINE

Filariasis Studies in American Samoa—William D. Murray.....	327
Gastro-enteritis Outbreak Due to Powdered Milk—Robert W. Babione...	342
NOTES ON CONTRIBUTORS.....	346

**Commanding officer, executive officer, and civilian consultants at
the Naval Hospital, Oakland, Calif.¹**



¹ Since this photograph was taken Dr. Ralph C. Benson, consultant in obstetrics and gynecology and Dr. Loren R. Chandler, consultant in surgery, have been added to the staff of consultants.

ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO No.



WASHINGTON 25, D. C.



20 March 1948

Fellow Officers of the Medical Department:

The Naval Dental Corps was established by Congress in 1912. After 36 years, it may be said to have reached maturity.

The remarkable progress made in this period has been high-lighted by the establishment of dental departments ashore and afloat, of the command by dental officers of schools, dental clinics and detachments within and beyond the continental limits of the United States, of billets for naval district and other staff dental officers, of a dental research activity, of a distinct rating structure for dental technicians, and of flag rank for the top administrative officers of the corps.

The Dental Corps is a valuable member of the group of corps which forms the Medical Department of the Navy. In addition to providing the vast amount of dental care necessary to promote the health of the officers and men of the Navy and Marine Corps, dental officers have done outstanding work in other fields. They have employed their skill not only as prosthodontists but also in the prosthetic replacement of other parts of the body. Notable has been the making of artificial eyes and the assistance given in cosmetic surgery of the face and jaw. Prosthetic treatment has been extended to practically all parts of the body, and has been particularly valuable in dealing with amputations. Here the skill of dental officers has been of value in planning and fitting artificial limbs.

The Naval Dental School at the National Naval Medical Center, Bethesda, Maryland from its inception has been an important postgraduate school for dental officers, whom it trains in all fields of dental science. It also is a training center for dental technicians of every type. Dental research has been developed both in this school and in the Naval Medical Research Institute.

It will be of interest to many to know the dental personnel situation as it existed at the beginning of 1948. There were on active duty with the Navy 933 dental officers, of whom 414 were members of the Naval Reserve. An additional 122 Naval Reserve dental officers were with the Army. There were 6,547 Naval Reserve dental officers on inactive duty. We had in the Navy then 1,485 dental technicians, including general technicians, prosthetic technicians, and dental repairmen. The number of dental officers authorized by law is based on a ratio of two per thousand of the total personnel, while the allowance of dental technicians is 1.75 per dental officer. The number of dental personnel on active duty is below the authorized total, and earnest effort is being made to fill the existing vacancies.

Sincerely,

A handwritten signature in dark ink, appearing to read "C. E. Swann".

Rear Admiral, Medical Corps
Surgeon General, United States Navy

U. S. NAVAL MEDICAL BULLETIN

Vol. 48

MARCH-APRIL 1948

No. 2

*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



DISEASES OF LEADING IMPORTANCE TO THE NAVY²

ROBERT L. WARE
Captain (MC) U. S. N.

A QUESTION frequently asked since the close of hostilities is, "What was the Navy's most important disease during the War?" While this simple question would seem to deserve a straightforward answer, it soon becomes apparent that the word, "importance," has a wide range of interpretations, and that a dozen individuals might review the record and determine a dozen different diseases as being the most important to the Navy. For example, one disease may have been outstanding at training stations during a given year, while a different one was of leading importance to Marines, or to enlisted personnel generally, or to personnel afloat. The Navy experience may be grouped in accordance with many different lines of cleavage, and as many different diseases may thereby be thrown into prominence. Diseases of importance at specific times or to selected groups of personnel are correctly considered important in the particular situation, but may be relegated to a lower position when evaluated in terms of the experience of the total naval forces.

¹The policy of the U. S. NAVAL MEDICAL BULLETIN as printed on the cover of its first issue and maintained throughout the 41 years of its existence.

²Statistics prepared by the Medical Statistics Division, Bureau of Medicine and Surgery, Navy Department.

In this presentation the entire strength of the Navy and Marine Corps is considered for the 4-year period 1942-45. Injuries due to enemy action are eliminated throughout the study, but all diseases and noncombat injuries are included.

Four different criteria are presented for evaluating the importance of the various diagnoses that contributed to the Navy's wartime experience. The total number of sick days, the frequency of incidence, the number of persons invalided from the service,³ and the number of deaths resulting from a given disease are four basic factors by which the importance of the disease to the Navy may be judged. In this study the leading diagnoses are shown in rank order for each of these categories.

While civilian health statistics are usually confined to the incidence of various conditions and the deaths attributable to them, it is useful from the Navy standpoint to study also the number of days lost from duty and the number of men lost from the service through invaliding. Sick days statistics not only show the manpower loss through illness but also give an indication of the work-load of the Medical Department, and thus constitute a useful gage of the importance to the Navy of a given disease. Similarly, the number of persons invalided from the service because of a specific disease is a necessary factor in evaluating the importance of the disease to the Navy since invaliding represents a permanent loss of manpower. The loss of manpower through invaliding from the service is difficult to estimate in terms of man-days. However, if it should be assumed that a man's services would have been utilized for one additional year if he had not been invalided, then it would be seen that the Navy lost more man-days through invaliding than through sick days in service.

It would be both impracticable and futile to undertake a comparison of the relative importance of sick days, incidence, invalidings, and deaths. There is no common denominator by which loss of life may be made equivalent in importance to a certain number of sick days or invalidings. Each of these factors is a separate measure of the importance of a given disease to the Navy, and the fact that the disease causing the greatest number of deaths produced only a relatively small proportion of the total sick days does not reduce the importance of the disease as the leading cause of death. However, it may be fairly considered that the importance of a condition to the Navy is increased when it stands among the leading causes in more than one of these four categories. That is, a condition ranking first in both sick days and

³ The term "Invalided from the service" means that an individual's service in the Navy or Marine Corps was terminated because of physical disability.

invalidings is of more concern to the Navy than if it ranked first in sick days only.

The five leading causes of sick days, incidence, invaliding, and disease and injury deaths are shown in the accompanying composite table (table 1). The percentage of the total contributed by each condition is shown, not only in the category where the condition ranks among the five leading causes, but in all other categories as well. The rank order also is shown if the condition ranked among the leading 15 conditions in a category. This method permits a more ready comparison of the over-all importance of the diagnoses which were of outstanding significance in any one of the categories.

TABLE 1.—*Leading causes of sick days, incidence, invalidings, and deaths, Navy and Marine Corps, 1942-45*

Diagnosis	Sick days		Incidence		Invalided from service		Deaths			
	106,616,336 = 100 percent		5,175,525 = 100 percent		318,919 = 100 percent		Disease— 5,346 = 100 percent		Injury— 22,197 = 100 percent	
	Per- cent of total	Rank order	Per- cent of total	Rank order	Per- cent of total	Rank order	Per- cent of total	Rank order	Per- cent of total	Rank order
Psychoneuroses, all types	4.9	I	1.3	XI	15.7	I	0			
Catarrhal fever, acute	4.7	II	17.7	I	0		0			
Fracture, simple	4.2	III	2.0	VIII	.5				3.9	V
Malaria	3.1	IV	2.2	VII	.2		1.5	XII		
Rheumatic fever	2.9	V	.3		1.7	XIV	1.0			
Gonococcal infection, urethra	1.9	IX	5.4	II	0		0			
Tonsillitis, acute	1.2	XV	4.2	III	.0		0			
Cellulitis	1.1		2.9	IV	0		0			
Gastro-enteritis, acute	.5		2.4	V	.0		.0			
Personality disorders	2.5	VI	.9		11.5	II	0			
Arthritis, chronic	1.9	VIII	.5		4.3	III	0			
Deformity acquired	1.0		.4		4.0	IV	.0			
Ulcer, duodenal	1.5	XII	.4		3.8	V	.7			
Coronary heart disease and thrombosis	.2		.0		.3		14.9	I		
Tuberculosis	1.3	XIII	.3		2.7	VIII	6.3	II		
Carcinoma	.1		.0		.0		5.1	III		
Appendicitis	1.6	XI	1.6	X	0		4.5	IV		
Pneumonia, broncho	.5		.4		.0		3.1	V		
Injuries, multiple, ext	.0		.2		.0				40.0	I
Drowning	0		.1		0				29.8	II
Wound, gunshot	.3		.1		.1				5.0	III
Fracture, compound	.8		.3		.1				4.7	IV

NOTES.—The 5 leading causes in each category are shown by bold-faced type. Rank order, indicated by roman numerals, is not shown for conditions ranking lower than XV.

It is apparent from an examination of table 1 that the five leading causes of sick days included the first cause of incidence, the first cause of invaliding, and the fifth cause of injury deaths. In each instance where a diagnosis appeared among the five leading causes in two categories, one of the categories was sick days. Moreover, in the whole list of 22 diagnoses, it is seen that a greater number had importance in the sick day category than in any other. This indicates that if a single criterion of importance were to be used the rank order

based on sick days would be more likely than any other to include the diseases of importance in other categories. This also illustrates the danger of basing conclusions as to the over-all importance of a diagnosis on any one criterion, and emphasizes the need to consider all of the factors.

SICK DAYS

Psychoneurosis ranked first as a cause of sick days and also ranked first as a cause of invaliding from the service, being the only condition to stand in the first rank in two categories. While no deaths were ascribed to psychoneurosis, the diagnosis had a fairly high standing in frequency of incidence, ranking eleventh in this category. It was the outstanding cause of manpower loss, both through sick days in the service and through loss of individuals by invaliding.

Catarrhal fever, acute, ranking a close second as a cause of sick days, was first in frequency of incidence. It accounted for more than one-sixth of all the cases admitted to the sick list, with more than three times the incidence of the second most common disease. Catarrhal fever, however, did not figure as a cause of either invaliding or of death.

Fracture, simple, stood third as a cause of sick days and fifth among injuries causing deaths. It also accounted for 2 percent of the total incidence, standing eighth in frequency of occurrence. The over-all importance of this diagnosis is shown by its prominence in three categories. While this condition had importance among injuries causing death, the frequency of the condition was such that the over-all fatality rate was only 8 deaths per 1,000 cases. Simple fracture of the skull was a prominent contributor to the deaths under this diagnosis.

The fourth and fifth ranking causes of sick days, malaria and rheumatic fever, did not reach that level of importance in any other category. Malaria, however, accounted for an appreciable proportion of the total incidence as well as of disease deaths, and rheumatic fever ranked fourteenth as a cause of invaliding.

INCIDENCE

Following catarrhal fever in frequency of incidence are gonorrhea; tonsillitis, acute; cellulitis, and gastro-enteritis. Together these conditions accounted for one-third of all diagnoses established during the war. However, none of these was of significance as a cause of invaliding or of death. With respect to man-days lost, the five leading causes of incidence accounted for 9.4 percent of the total sick days as compared with 11.8 percent accumulated by the five leading causes of invaliding. It is clear that the five most common diseases are not of importance from the standpoint of permanent manpower loss to the Navy and are secondary to less frequent diseases as a cause of sick days. These common diseases of high frequency derive their importance rather

from their relationship to communicable disease control, and from the work-load laid upon the Medical Department by the sheer numbers of individuals to be treated for these conditions.

INVALIDINGS

The five leading causes of invaliding from the service account for 39.3 percent of all invalidings. It will be noted that two of the major types of neuropsychiatric disorders lead the list by a considerable margin, reflecting the prominence of the entire class of mental diseases as a cause for invaliding. The psychoneuroses, already mentioned as the leading cause of invaliding, were followed by personality disorders; arthritis, chronic; deformity, acquired; and duodenal ulcer. As a group these conditions make up only a modest proportion of the incidence, but figured rather heavily as a cause of sick days. The number of deaths ascribed to the five leading causes of invaliding was proportionately quite small.

It is of interest to note the high ratio of invalidings to incidence in these conditions. Invaliding from the service resulted for roughly three in every four men in whom the diagnosis of personality disorder or psychoneurosis was made. For duodenal ulcer and deformity acquired, the ratio was about five in eight, and for chronic arthritis about one in two.

DEATHS

There were 22,197 deaths due to noncombat injury during the four-year period, as contrasted with 5,346 deaths due to disease. Since disease deaths constitute such a small proportion of the total non-combat deaths, the disease causes are ranked separately in order to distinguish better their relative importance.

Coronary heart disease (including coronary thrombosis) is by far the outstanding disease causing death, accounting for more than one-seventh of the total disease deaths, though not having important standing with respect to sick days, incidence or invalidings. Tuberculosis, which has a fairly high rank both as a cause of invaliding and of sick days, is second as a disease causing death. Following in order are carcinoma, appendicitis, and broncho-pneumonia. Of the latter, only appendicitis has any marked standing in other categories.

The majority of the noncombat deaths due to injury resulted from injuries multiple, extreme (40 percent of total) and drowning (29.8 percent). These diagnoses are followed by wound, gunshot; fracture, compound; and fracture, simple. Sick days and invalidings play an inconsequential part in the evaluation of extreme multiple injuries, and no part at all with respect to drowning, due to the nature of these diagnoses. Incidence and deaths are, of course, equal in the case of

drowning and essentially so for injuries, multiple, extreme. Consequently these diagnoses are to be evaluated solely as causes of death. Remembering that combat casualties are excluded, it is of interest to note that drowning, which for years was the Navy's leading cause of death, ranked second during the war.

Direct comparison of the Navy's mortality data with that of the civilian population of the United States must be made with caution because of the obvious differences in the make-up of the two groups. It is of interest to note, however, that heart disease and cancer, which led the list of causes of death in the United States ⁴ and are ordinarily associated with the older age groups, were also prominently represented in the Navy. A different picture is seen with respect to injury deaths, which accounted for 81 percent of the Navy's noncombat mortality and only 8 percent of the total deaths in the United States.

The fatality rates for the leading causes of death from disease and injury are shown in table 2. These figures show that some of the conditions owe their high rank as a cause of death to a high frequency of incidence and a relatively low fatality rate, while others of less common occurrence become important causes of death because of high fatality rates.

TABLE 2.—*Fatality rates per 100 cases for leading causes of death, Navy and Marine Corps, 1942-45*

<i>Diagnosis</i>	<i>Deaths per 100 cases</i>
Diseases:	
Carcinoma.....	27.9
Coronary heart disease.....	27.6
Tuberculosis.....	2.5
Broncho-pneumonia.....	.9
Appendicitis.....	.3
Noncombat injuries:	
Drowning.....	100.0
Injuries, multiple, extreme.....	90.1
Wound, gunshot.....	17.8
Fracture, compound.....	8.1
Fracture, simple.....	.8

The foregoing discussion has been limited to the five conditions of highest rank in each of the stated categories. It is recognized that the list shown in table 1 excludes a number of diagnoses which in importance closely approach those that were listed. As a means of showing the relative position of some of these, a supplementary composite table has been prepared (table 3), in which is shown every additional diagnosis that accounted for as much as 2 percent of the total in any category.

⁴ National Office of Vital Statistics, U. S. Public Health Service, Federal Security Agency: Vital Statistics—Special Reports: Vol. 27, No. 2, May 16, 1947.

TABLE 3.—*Additional conditions causing 2 percent or more of sick days, incidence, invalidings, or deaths, Navy and Marine Corps, 1942-45*

	Sick days— 106,616,336= 100 percent		Incidence— 5,175,525= 100 percent		Invalided from service— 318,919=100 percent		Deaths			
	Per- cent of total	Rank order	Per- cent of total	Rank order	Per- cent of total	Rank order	Per- cent of total	Rank order	Per- cent of total	Rank order
Hernia, inguinal	2.0	VII	1.0		0.3		.0			
Pharyngitis, acute	.6		2.2	VI	.0		.0			
Tonsillitis, chronic	1.0		2.0	IX	.0		.0			
Asthma	1.1		.4		3.4	VI	0			
Flatfoot	.7		.3		2.7	VII	0			
Schizophrenia	1.1		.2		2.5	IX	.3			
Otitis media, chronic	.6		.3		2.3	X	.1			
Cerebral thrombosis and hemorrhage	.0		.0		.0		3.0	VI		
Leukemia	.0		.0		.0		3.0	VII		
Nephritis	.2		.1		.3		2.5	VIII		
Meningitis	.0		.0		.0		2.2	IX		
Burns	.4		.5		.0				3.0	VI
Intracranial injuries	.4		.3		.6				2.5	VII

NOTES.—Rank order, indicated by roman numerals, is not shown for conditions ranking lower than XV.

The 35 diagnoses contained in tables 1 and 3, together accounted for about 44 percent of all the sick days, 51 percent of the total incidence, 57 percent of the invalidings, 48 percent of the disease deaths, and 89 percent of the deaths from noncombat injury. The remaining proportions of these various factors were distributed among some 1,400 other reported diagnoses. It is clear that these lists include the conditions that were of the most outstanding importance in reducing the manpower behind the Navy's guns.

It has been shown that neither of the four criteria of importance used in this presentation is alone adequate for the full appraisal of a disease. Each contributes a specific type of information, all of which must be integrated for a general evaluation. However, it is apparent that a high rank as a cause of sick days is more likely to be associated with importance in other fields than is high rank in any other category. Figures on sick days also provide the best index to Medical Department work-load, and are important considerations in connection with Navy manpower loss. These facts suggest that a more extensive use of sick day statistics would be rewarding.

The question of the single disease most important to the Navy during the war has not been answered, nor can it be. From the standpoint of manpower loss to the Navy, it is clear that psychoneuroses led all the rest, but there is no way of comparing the importance of this manpower loss with the loss of life attributed to the leading causes of death. It is also impossible to measure the ultimate importance of all the possible ramifications of the most common disease, catarrhal fever.

Each of the criteria furnishes a different approach to the problem, and a consideration of the relative importance of a disease in all categories will permit evaluations to be made in terms of over-all importance.



INTRAMEDULLARY FIXATION OF FRACTURES OF THE FEMUR

HOWELL E. WIGGINS
Commander (MC) U. S. N.

and

GWILYM B. LEWIS
Lieutenant Commander (MC) U. S. N.

ALTHOUGH intramedullary fixation of fractures of the long bones is not new, Lambotte having utilized it as early as 1910, the method was popularized by Kuntscher in 1940. In his first paper, presented in March 1940, to the Deutsche Kongress Fur Chirurgie, he showed convincingly that axial osteosynthesis could be utilized in fixations of fractures of the long bones. Recently Mac Ausland (2) in this country published a report of seven fractures of the long bones treated by the Kuntscher medullary splinting technique with gratifying success. This, and other recent reports in the literature, led us to utilize this method in several femoral fractures.

As is well known, fractures of the femur situated just below the lesser trochanter are extremely difficult, if not at times impossible, to treat by any closed method of reduction, due to the mesial displacement of the distal fragment, together with the abduction and flexion of the proximal fragment. This type of fracture is usually handled by long surgical procedures which entail plating. It was felt that any method which would assure anatomical reduction, ease of technique, and rapidity of operating time would offer an ideal solution for this particular type of fracture. In addition to this we were impressed by the reported obviation of postoperative immobilization, and the apparent lack of untoward complications with intramedullary fixation. We were not impressed with the utilization of this procedure for fractures of other long bones, since standard present-day treatment has been found to be satisfactory as regards end results.

The intramedullary nails utilized in the cases reported were of 18-8 stainless steel, 15 inches in length, five-sixteenths of an inch or three-eighths of an inch outside diameter, and 0.35 inch in thickness. The nails were slotted in order to accommodate the handle of the guide (fig. 1).

Our technique of insertion of the nail was at variance with that originally described by Kuntscher, due primarily to our inexperience with

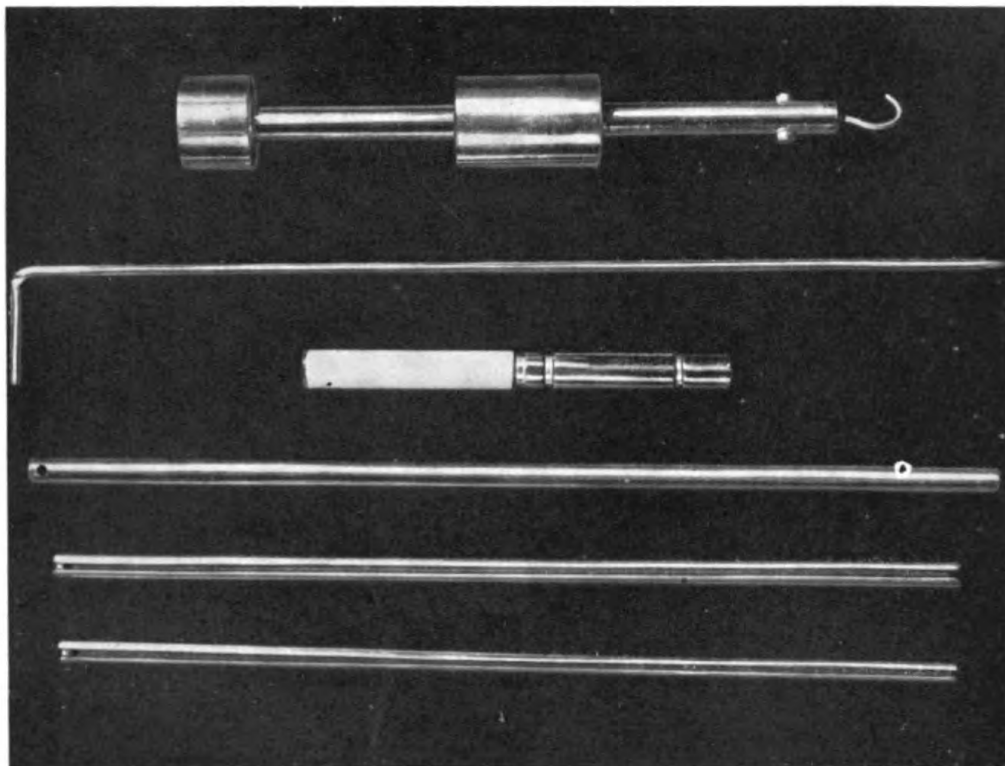


Figure 1.—Illustrating the instruments used in the procedure of intramedullary fixation. From above downward: extractor, guide, driver, three-eighths, five-sixteenths, and one-quarter inch intramedullary nails.



Figure 2.—Positioning of the patient for the operative procedure.



Figure 3.—*Illustrating the insertion of the one-quarter inch drill bit, 12 inches in length, in the intramedullary cavity of the proximal fragment.*

this method of fixation. The patient was taken to the operating room, administered spinal anesthesia, and placed in lateral decubitus lying on his sound side (fig. 2). The hip of the involved extremity was flexed to approximately 80° . The entire lateral aspect of the thigh was surgically prepared from the iliac crest to the knee. A vertical incision was made overlying the site of fracture and using bone-grasp- ing forceps the proximal fragment was brought into the operative wound. With a drill bit one-fourth inch in diameter and 12 inches in length, a hole was drilled in the superior medial aspect of the greater trochanter by traversing the medullary cavity of the proximal frag- ment in a retrograde manner (fig. 3). The guide was then inserted in the medullary canal at the distal end of the proximal fragment, traversing the medullary cavity, the drill hole, and thence externally until the guide could be palpated lying just beneath the skin on the posterolateral aspect of the buttock. A stab wound was then made in the skin overlying the guide and the point exposed. The nail selected was then fitted over the guide and driven distally (fig. 4) by use of the driver until the nail could be visualized emerging from the medullary cavity at the distal end of the proximal fragment. The fracture was then reduced under direct vision and the nail driven

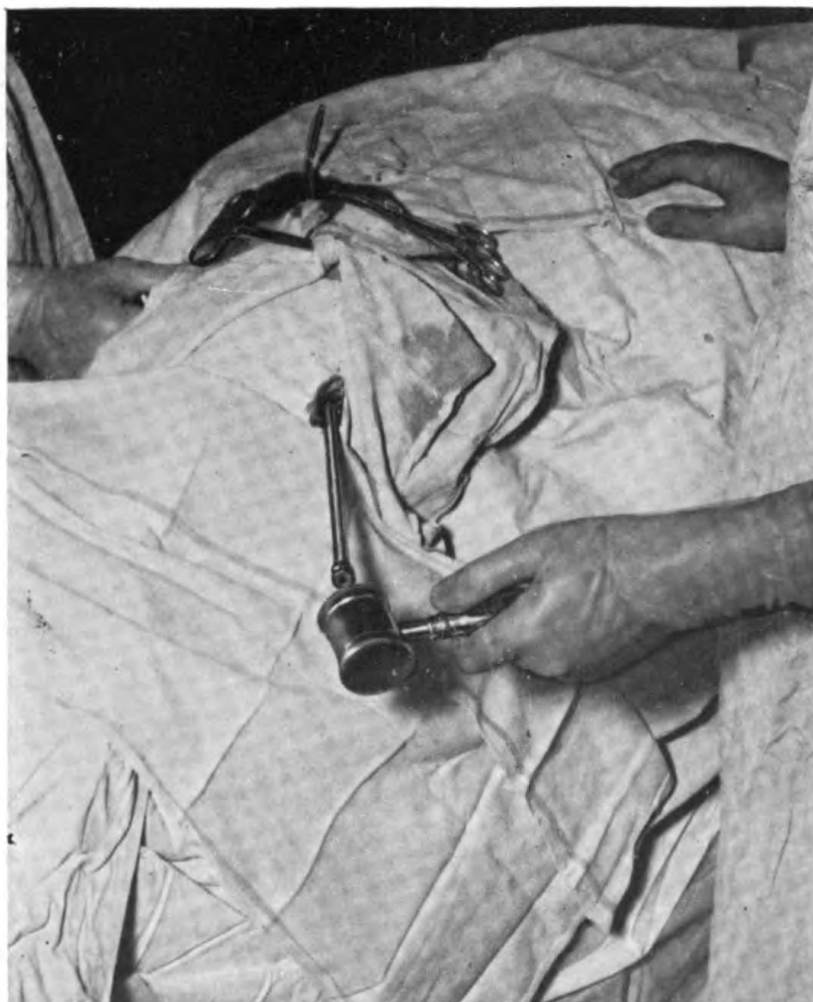


Figure 4.—*The guide has been inserted in the medullary cavity of the proximal fragment in a retrograde manner and the nail is being driven distally over the guide.*

distally in the medullary cavity of the distal fragment until approximately 1 inch of the nail protruded above the superior aspect of the greater trochanter. Both operative wounds were then closed using absorbable sutures throughout except for the skin.

In the first two cases of this series, the postoperative care consisted of no external immobilization, with deferment of weight bearing until clinical and roentgenological union had occurred. The complication of bending of the nail in *our third case*, led to the use of postoperative skeletal traction immobilization in the remainder of the series. In this respect it has been our experience that an anatomically accurate fit of the nail in the intramedullary canal is not essential if such immobilization is used.

CASE REPORTS

Case 1.—C. S. Jr., a white male Veterans' Administration patient, aged 20, sustained a fracture-dislocation of the second lumbar vertebra with complete paraplegia, multiple rib fractures, and a simple fracture of the upper one-third of the right femur (fig. 5), on 23 February 1947. He was transferred to this hospital on 5 March 1947, arriving in a body cast, and a Thomas splint with Spanish windlass traction to the right lower extremity. There was early dry gangrene of the right foot. A hemopneumothorax was present on admission.

On 11 March 1947 a laminectomy with decompression of the cord was performed. However there was no immediate improvement of paraplegic symptoms. Postoperatively, the fractured femur constituted a problem in treatment and nursing care. Maintenance of the extremity in a skeletal traction apparatus was not compatible with paraplegic nursing care. Clonic activity of the extremity complicated the problem. It was decided that the case presented sufficient indication for intramedullary fixation. This was performed on 27 March 1947 and was the initial case of this series.

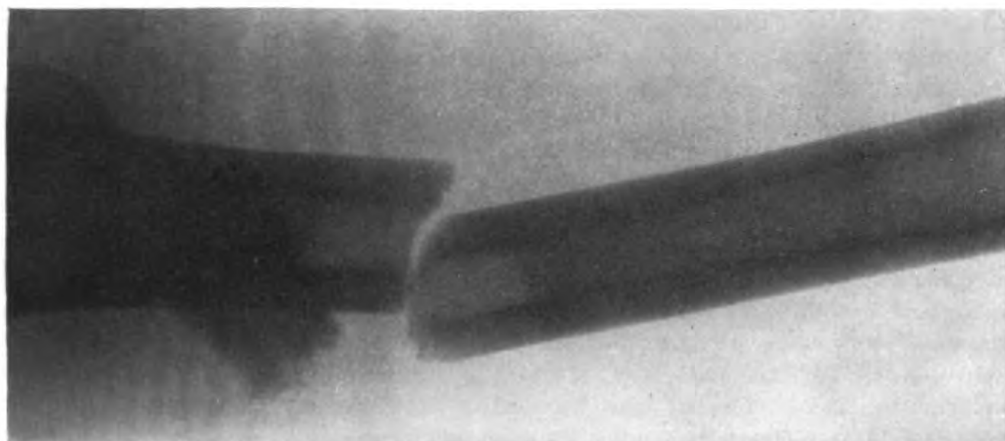


Figure 5.—Case 1. Preoperative lateral x-ray.

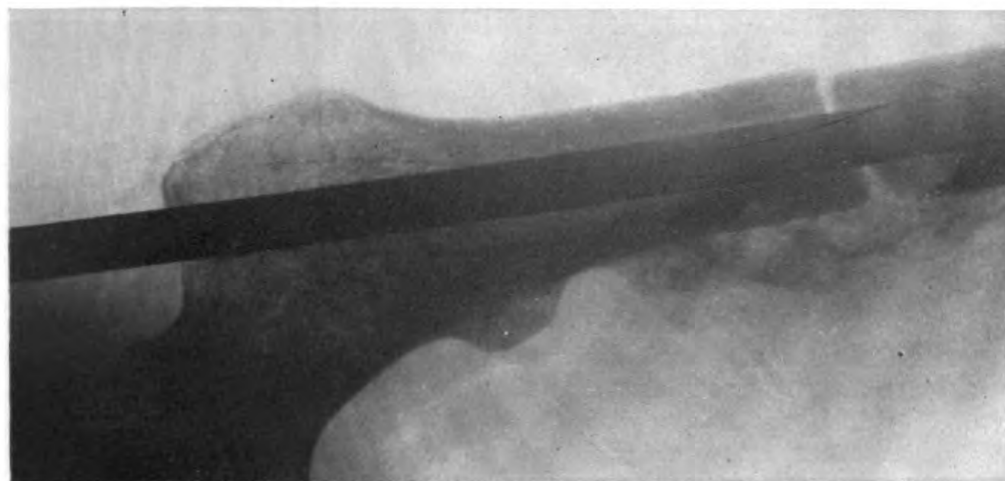


Figure 6.—Case 1. Postoperative anterior-posterior x-ray.

From the day of surgery, the extremity was handled and moved in the care of the patient like a normal limb. By 24 April 1947 it was evident that there was going to be minimal improvement of the paraplegia. The right foot had become completely demarcated and on the above date, a guillotine amputation at the site of election below the knee was performed. On 5 June 1947 skin grafts of the stump and of a sacral decubitus were carried out. Shortly after this the skin began to break down over the proximal end of the intramedullary nail, which had been placed with about 2 inches protruding above the greater trochanter. Roentgenograms showed marked callus (fig. 6) and union was considered solid radiographically. On 1 July 1947 the nail was visible in the decubitus, and was extracted. The femur was clinically solid after extraction, but in a few days, in the course of routine care, the femur refractured through the callus at the site of original fracture. On 27 August 1947 at the time of the patient's transfer to a veterans' paraplegic center, the right thigh was flail at the fracture level.

Case 2. M. H. D., a white female dependent patient, aged 26, sustained a simple fracture of the right femur in its middle third, on 3 March 1947. Treatment prior to arrival at this hospital had consisted of the insertion of a Steinman pin through the proximal tibia in order to provide skeletal traction, followed by the application of a single hip spica.

Upon arrival the roentgenological examination of the involved extremity gave evidence of a transverse fracture of the middle third, with $1\frac{1}{2}$ inches of overriding, and with marked posterior and lateral displacement of the main distal fragment. All indicated laboratory procedures were within normal limits.

On 28 March 1947, the day following her admission, the single hip spica was removed and a long leg plaster cast was applied on the right, incorporating the Steinman pin to provide skeletal traction. The cast was suspended from an overhead Balkan frame and 15 pounds traction applied in line with the femur. On 3 April 1947 a follow-up x-ray showed no change in the position of the femoral fragments, and early callus formation was evident.

On 4 April 1947 the patient was taken to surgery and an open reduction of the fracture was performed with fixation of the fragments utilizing the intramedullary nail. The postoperative course was entirely uneventful and on 20 April 1947 she was ambulatory on crutches, but with no weight bearing. On 6 May 1947 x-ray findings revealed anatomical alignment of the fragments with evidence of good callus formation. On 20 June 1947 the patient was fitted with an ischial weight-bearing caliper and discharged from the hospital. Her range of motion on the involved side was extension 175° ; flexion 80° .

On 18 September 1947 there was roentgenological evidence of exuberant callus formation. The patient was taken to surgery and under spinal anesthesia the nail was easily removed using the extractor. The convalescence from this procedure was completely uneventful and the patient was allowed to bear full weight, without protection, the second postoperative day. She was discharged home on 28 September 1947 completely asymptomatic and with a full range of motion of the right knee.

Case 3.—J. O. B., a 21-year-old colored male steward's mate, first class, on 8 June 1947 sustained a simple fracture in the upper one-third of the left femur with overriding and posterior and mesial displacement of the distal fragment (fig. 7). On 11 June 1947 an open reduction was performed under spinal anesthesia. In this case the nail guide was driven out of the proximal end of the shaft only with the greatest difficulty and with the definite danger of splitting the cortex. It was found equally difficult to drive the nail back through the cortex in the proximal end of the shaft. However, the nail was finally suitably introduced and the fracture reduced. Because of the large size of the bone, the largest

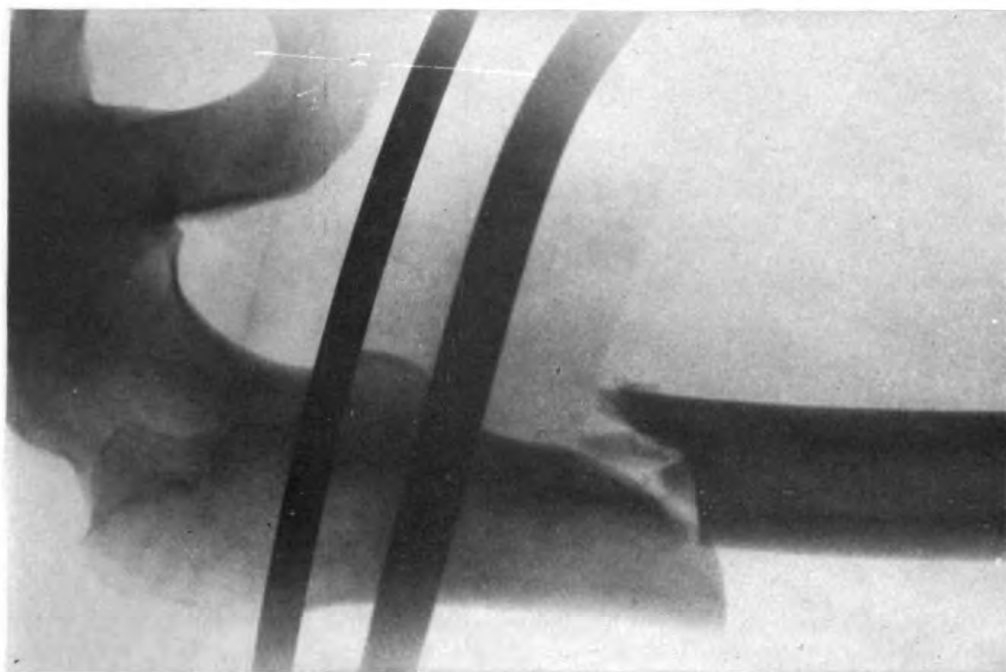


Figure 7.—Case 3. Preoperative anterior-posterior x-ray.

and strongest of our intramedullary nails was used. As a further precaution, immediately on return of the patient to the ward, he was placed in Russell's traction with the utilization of 6 pounds weight, providing approximately 12 pounds traction on the femoral shaft. Portable postoperative x-rays showed satisfactory reduction with a minimal degree of bending of the nail at the fracture site (fig. 8).

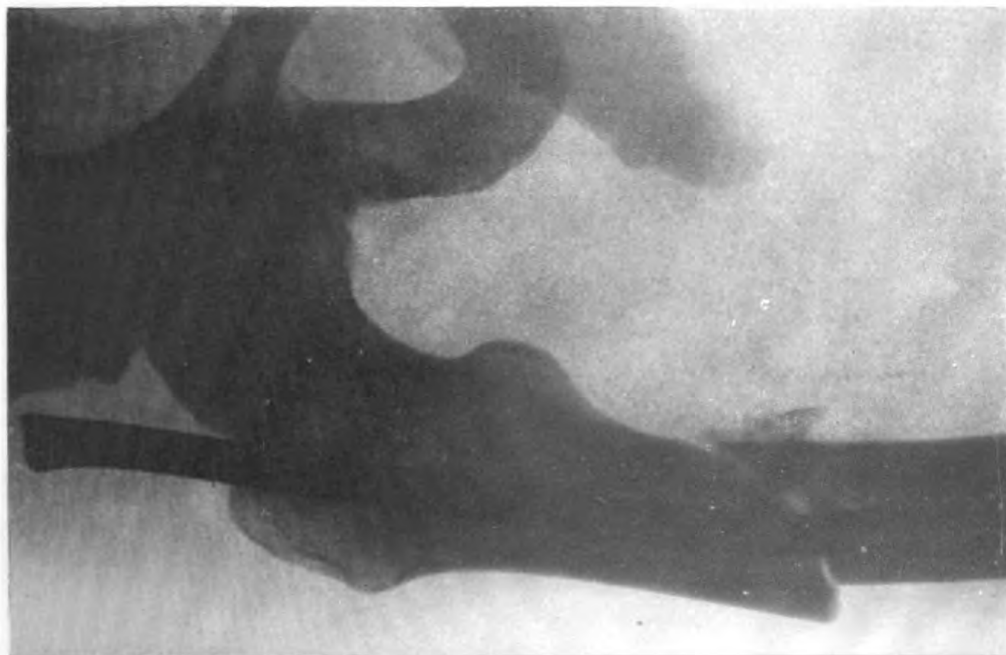


Figure 8.—Case 3. Postoperative anterior-posterior x-ray.

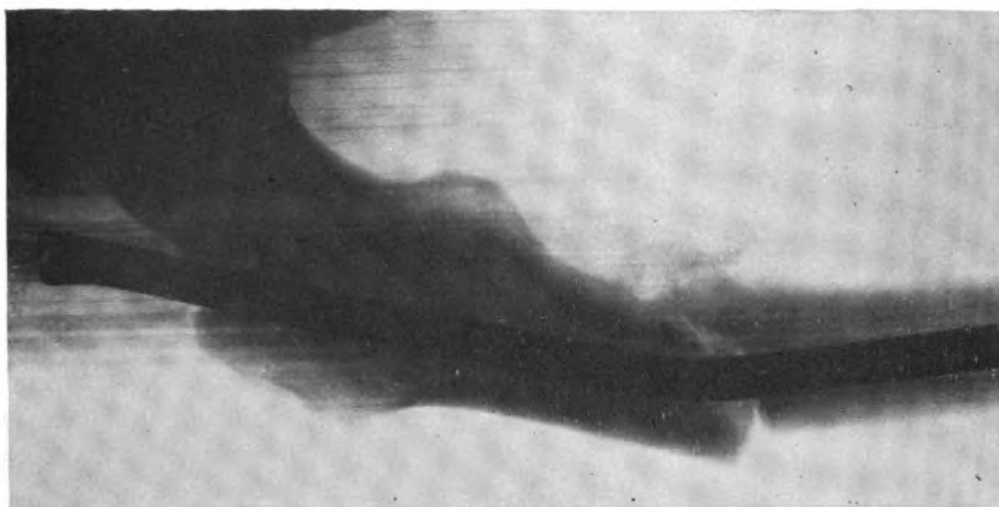


Figure 9.—Case 3. Postoperative anterior-posterior x-ray at 4 weeks.

Check x-rays on 16 July 1947 showed considerable callus formation, but in addition there was a marked increase in bending of the nail at the site of fracture, with the distal fragment angulated mesially and posteriorly (figs. 9 and 10). This was believed to result from muscle pull, despite traction. To prevent a further increase in bending, on 18 July 1947 a high single hip spica cast was applied. Check films on removal of the cast on 28 August 1947 showed abundant callus and no increase in angulation. The extremity was fitted with a long leg ischial weight-bearing walking caliper on 1 September 1947. The brace was discarded on 1 November 1947. X-rays showed the formation of callus and the angulation to be stationary (figs. 11 and 12). There was a full range of motion

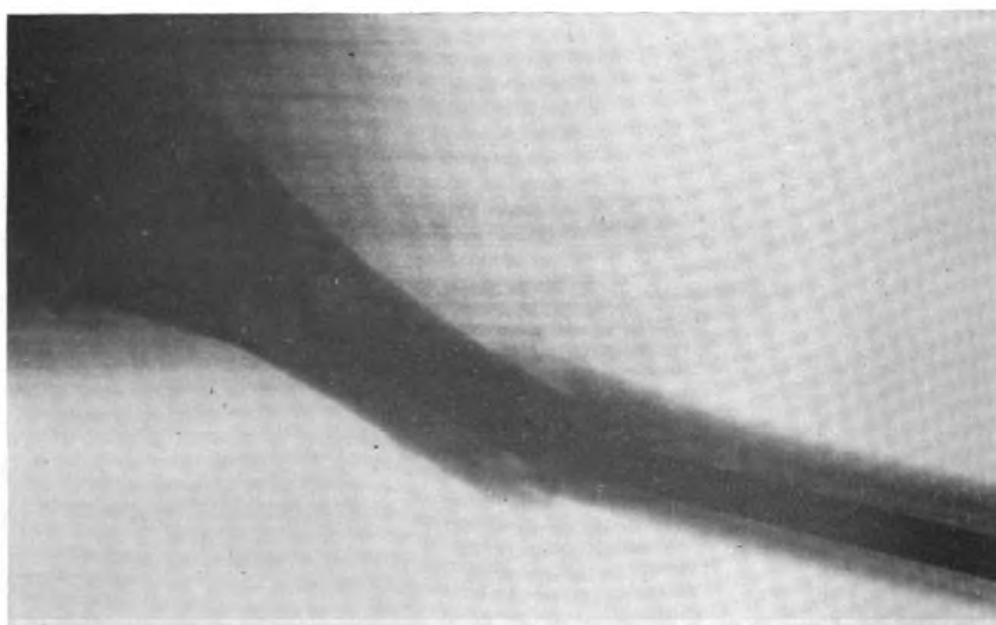


Figure 10.—Case 3. Postoperative lateral x-ray at 4 weeks.

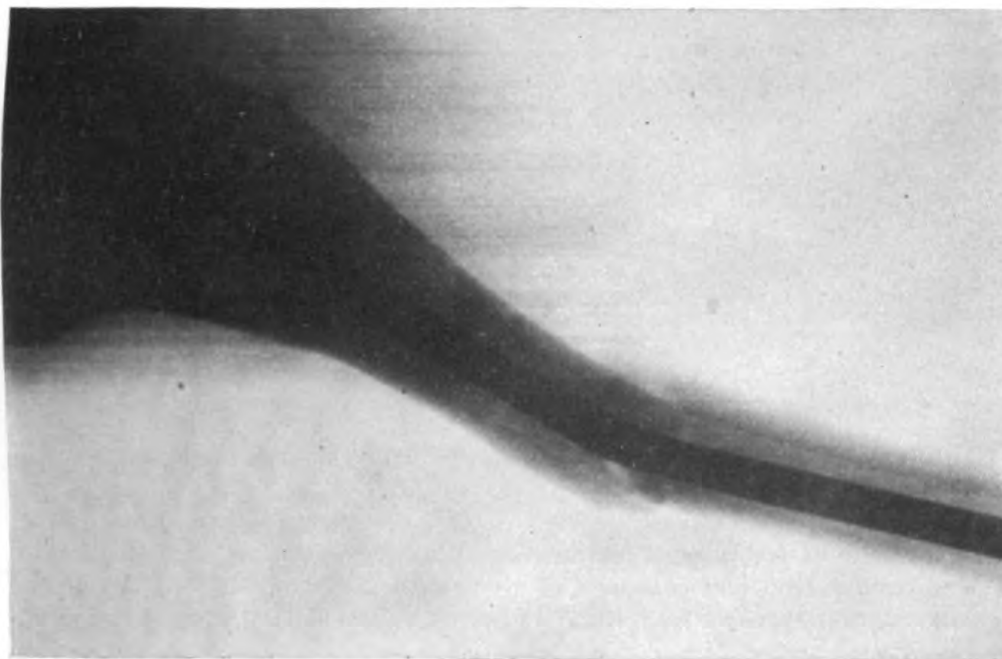


Figure 11.—Case 3. Postoperative lateral x-ray at 5 months.

at the knee and hip, and although there was one-half inch shortening of the extremity, the gait was normal. There was one-half inch atrophy of the left thigh.

In view of the excellent clinical result, the patient was returned to duty on 14 November 1947. Extraction will be deferred until such time as a definite indication for removal may arise. We are not unaware of the technical difficulties that may be attendant upon removal of the nail.

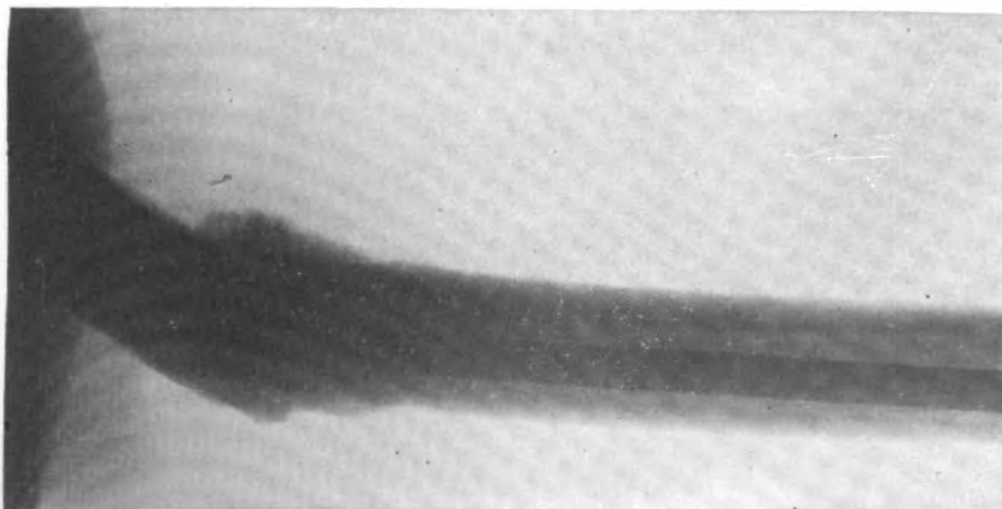


Figure 12.—Case 3. Postoperative anterior-posterior x-ray at 5 months.

Case 4.—R. L. R., a white male seaman, first class, aged 20, on 13 September 1946 sustained a compound fracture of the right femur in the lower third, and a simple fracture of the left femur in the middle third, together with extensive

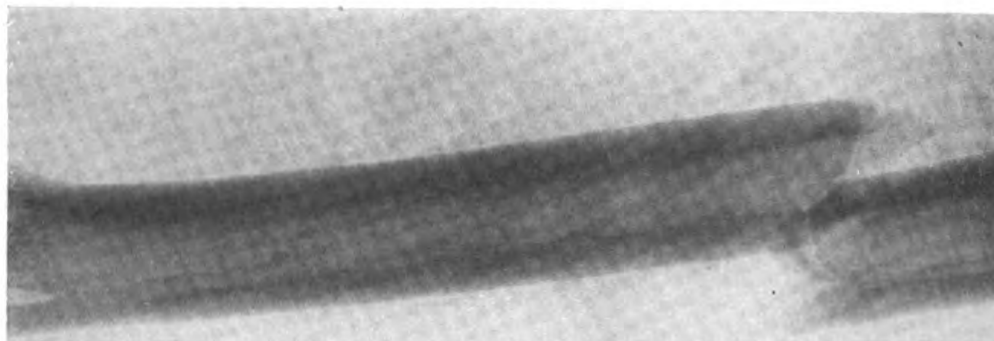


Figure 13.—Case 4. Preoperative anterior-posterior x-ray.

damage to both the tibial and peroneal components of the sciatic nerve on the left at the site of fracture. Treatment prior to his admission to this hospital on 1 November 1946 had consisted of wound debridement and application of skeletal traction through both tibial tubercles, followed by the application of a double hip spica.

On admission here x-rays taken through plaster revealed a transverse fracture through the lower one-third of the right femur with 1 inch of overriding and posterior displacement of the distal fragment. Views of the left femur revealed a comminuted fracture involving the middle third of the shaft with the fragments in approximately 50 percent approximation (figs. 13 and 14). When the plaster was removed there was found to be severe edema of both lower extremities, more pronounced on the left. There were large pressure sores over the left foot and heel. Various types of immobilization and traction were applied to both extremities. However after 8 months of treatment there was a persistent nonunion on the left, and only a limited union on the right. Because of a slowly progressive down-hill course, and in an attempt to provide early ambulation, on 16 June 1947 an open reduction of the fracture of the left femur was performed with fixation utilizing the intramedullary nail. To

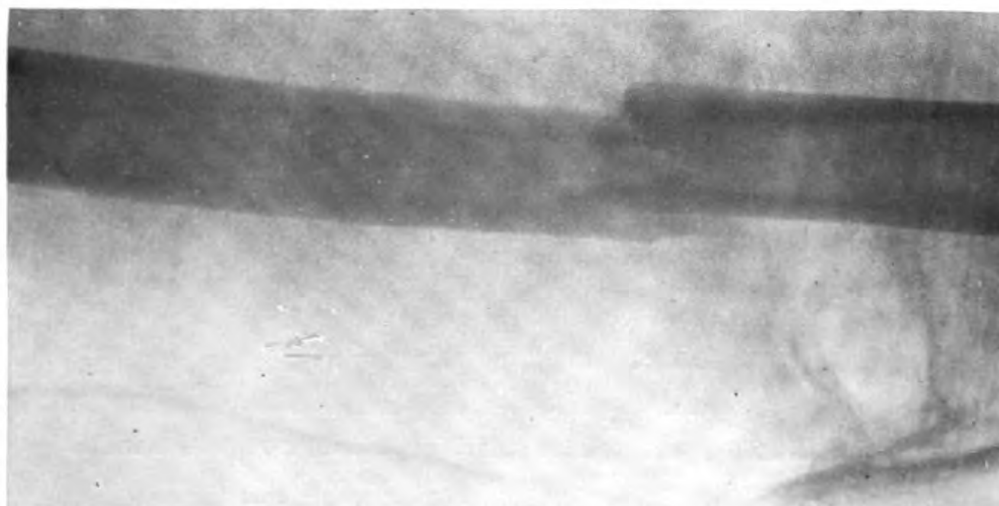


Figure 14.—Case 4. Preoperative lateral x-ray.

our great surprise, there was marked improvement postoperatively in the severe edema of the left lower extremity. At the present time, the left femur is in anatomical alignment but there is little evidence of callus formation (fig. 15). The patient is ambulatory in bilateral ischial weight-bearing calipers. The right foot and ankle are essentially normal. The left foot and ankle are stiff and fibrotic from the prolonged edema and immobilization. Sensation in the left foot is of the protopathic type which is found in regenerating nerves.

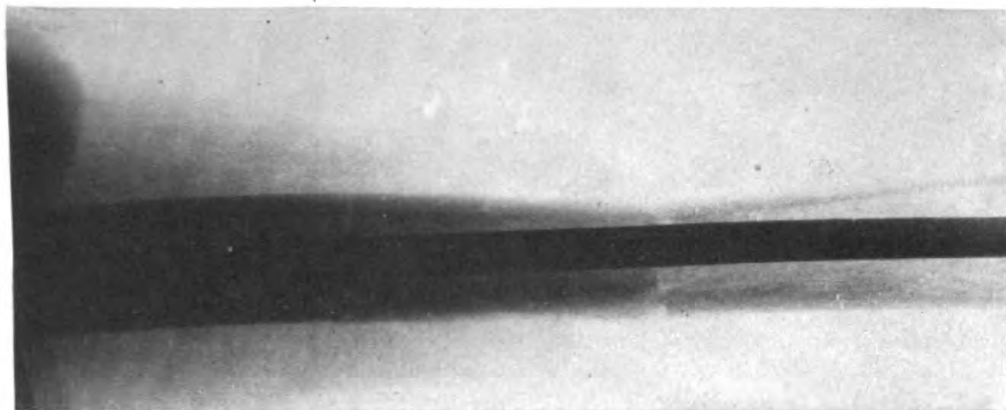


Figure 15.—Case 4. Postoperative anterior-posterior x-ray.

Case 5.—*B. C. A.*, a 21-year-old white male Marine PFC, sustained a simple comminuted fracture of the junction of the middle and upper one-third of the left femur on 13 July 1947 (fig. 16). On admission to this hospital the extremity was placed in a fracture frame with 23 pounds traction through a tibial tubercle Kirschner wire. Reduction was not accomplished with simple traction and on 23 July 1947 manipulative closed reduction was attempted under pentothal and gas anesthesia. No bony crepitus could be elicited and the fragments could not be approximated. It was concluded that there was considerable soft tissue interposition, and that open reduction would be necessary. On 28 July 1947 an open reduction with fixation of the fracture utilizing the intramedullary nail was performed.

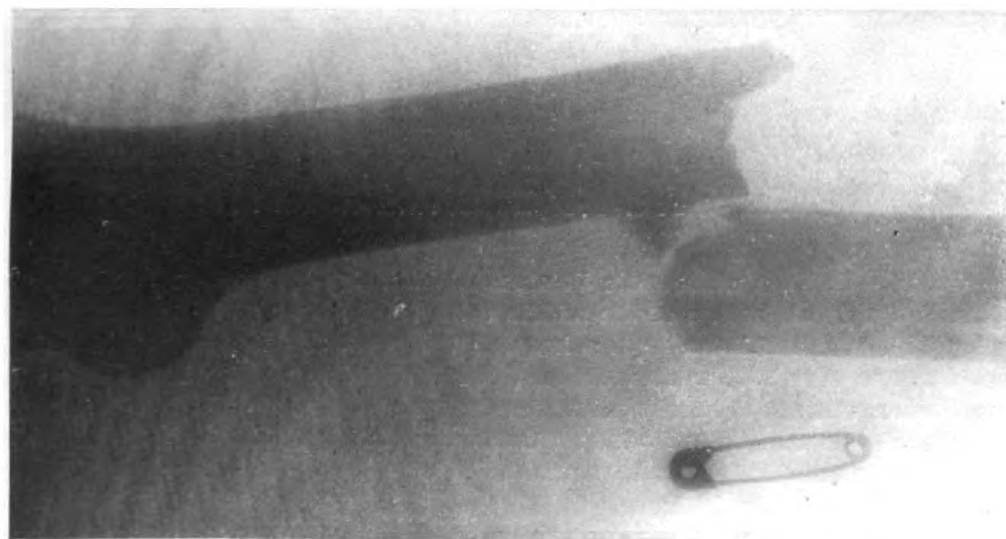


Figure 16.—Case 5. Preoperative anterior-posterior x-ray.



Figure 17.—Case 5. Postoperative anterior-posterior x-ray.

The postoperative course was uneventful. Sutures were removed on the fourteenth day. X-rays taken in traction on 14 August 1947 showed callus bridging the fracture site. There was only very slight angulation of the nail (fig. 17). The extremity was kept in traction for 8 weeks, following which the patient was allowed up in wheel chair. There was a nearly complete range of motion at the knee. On 1 October 1947 the patient was fitted with a long leg ischial weight-bearing caliper. At the present time the patient is fully ambulatory in the brace. There is abundant callus, and bony trabeculation across the fracture site.



Figure 18.—Case 6. Preoperative anterior-posterior x-ray.

Case 6.—L. B., a white male Veterans' Administration patient, aged 24, sustained a simple fracture of the middle third right femur on 15 November 1947 (fig. 18). On admission to this hospital the extremity was placed in a fracture frame with 20 pounds traction through a tibial tubercle Kirschner wire. Reduction was not accomplished with simple traction and on 21 November 1947 and again on 24 November 1947 closed reduction under sodium pentothal-nitrous oxide anesthesia was attempted but ended in failure due to the obliquity of the fracture. On 28 November 1947 the patient was taken to surgery and an open reduction with intramedullary fixation was performed (fig. 19). The patient was returned to the ward and the extremity placed in balanced trac-

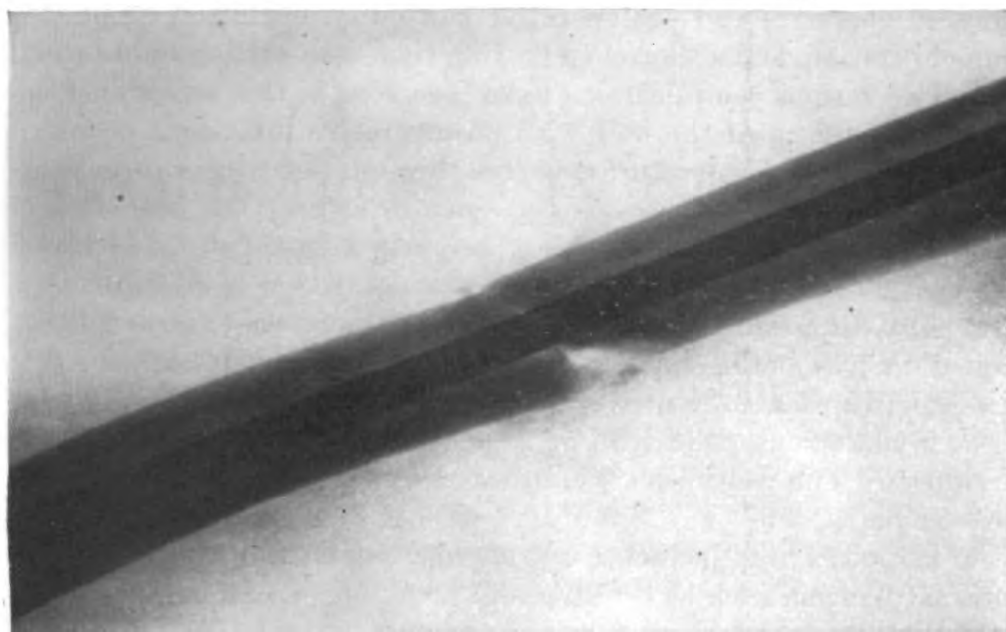


Figure 19.—Case 6. Postoperative anterior-posterior x-ray.

tion with 8 pounds traction through the tibial tubercle. The postoperative course has been completely uneventful. The sutures were removed on 9 December 1947 and the wound was found to have healed by primary intention.

SUMMARY

1. The internal fixation of fracture by means of the intramedullary nail after the method of Kuntscher has been found useful in the treatment of certain fractures of the femur.
2. A technique of introducing the intramedullary nail, requiring a minimum of special equipment and adaptable to the standard operating room facilities is described.
3. Summaries of a series of six cases of fractures of the femur treated by intramedullary fixation are presented.

COMMENTS AND CONCLUSIONS

1. Internal fixation by means of the intramedullary nail may be substituted for other methods of fixation when open reduction is necessary. It is our present view that intramedullary fixation is not indicated except in femoral fractures, and only those in which closed reduction has failed, or which for other reasons must be openly reduced.
2. In our hands the method has been useful in handling several femoral fracture problems; e. g., acute fractures of the upper one-third of the shaft, old unreduced fractures, old nonunions, and shaft fractures in paraplegics.
3. The advantages over other methods of internal fixation are: a technically easier operative procedure, a shortened operative time, a

lowered operative and postoperative morbidity, obviation of plaster immobilization, and a shortened healing time with earlier ambulation.

4. Two serious complications have been seen in this series; refracture and bending of the nail. No postoperative infections occurred in our cases. The refracture occurred through the callus in the paraplegic patient when it became necessary to extract the nail after 3 months. Although there may have been neurotropic factors involved, the nail should not be removed before trabeculation is established.

In spite of postoperative immobilization there was marked bending of the nail at the fracture site in one case. It would appear that the American manufactured rolled sheet stainless steel nail available to us is not strong enough to provide satisfactory fixation in all individuals. The European literature describes the use of a much heavier nail.

5. There is a high incidence of complications with other methods of internal fixation such as bending and breaking of plates, distraction of fragments, poor callus formation, nonunion, pseudarthrosis, and infection. It would seem that the complications of our series should not contraindicate further use of the method.

6. With the type of nail used in this series, light skeletal balanced traction, with exercise of the joints, should be maintained until the patient is ready for a brace. An ischial weight-bearing caliper should be worn until solid union is present. The nail should not be removed early. Eventual extraction of the nail would seem desirable, but the literature does not indicate it to be requisite.

7. Our experience in using the nail to facilitate the nursing care of a paraplegic offers promise of usefulness in pathological fractures and pseudarthroses. It would also seem that the potentialities of military application are of special interest.

REFERENCES

1. BOHLER, L.: Die Technik der Knochenbruchbehandlung im Frieden und im Kriege. 5 bis 8 Auflage, Band III, Die Marknagelung nach Kuntscher. Wien, Wilhelm Maudrich, 1944.
2. MACAUSLAND, W. R.: Medullary nailing of fractures of long bones. Surg., Gynec. & Obst. 84: 85-89, 1947.
3. SOEUR, R.: Intramedullary pinning of diaphyseal fractures. J. Bone & Joint Surg. 28: 300-331, 1946.



SPECIFIC THERAPY IN OSTEOMYELITIS

JOHN W. METCALFE
Commander (MC) U. S. N.

ALTHOUGH the literature on this age-old disease is exceedingly voluminous certain features in the clinical management of diagnosis and specific treatment of osteomyelitis appear to be worthy of emphasis at this time. It has been the observation of the author that these cases are usually first seen by some physician or surgeon other than the one charged with the long-range treatment of the disease. The watch officer or referring physician will often be misled by the systemic symptoms and fail to make adequate preliminary tests before the institution of nonspecific treatment which may mask the symptoms which would lead to an early specific diagnosis.

For a complete summary of the literature on this subject references are cited in the bibliography. In brief, osteomyelitis is an infection of bone produced by implantation of bacteria in wound infection or by the seeding of septic emboli in a bacteremia. This latter state is generally considered to be transitory, but this is not always true as is illustrated in the case reports to follow. More frequently the house officer fails to order blood cultures and the specific organism and its susceptibilities are not determined. *Staphylococcus aureus* is the most frequently found causative organism, comprising 90 percent of the infections. *Streptococci*, *pneumonococci* and members of the *ebberthella*, *salmonella*, and enteritidis groups are other offenders. Entry into the body is gained from infected teeth, furuncles, varied infections and the intestinal tract.

It is believed that emboli plug the terminal branches of the nutrient artery, producing a septic infarct, usually in the metaphasis. A localized abscess in the bone follows, which may rupture through the epiphyseal plate into the joint or peripherally through the periosteum to form a soft tissue abscess. Periosteal reaction is shown by the development of an involucrum which is first seen roentgenographically as radially developing bone spicules. Sequestration occurs commonly in the long bones, but is less favored in cancellous bone because of the more diffuse source of blood supply. Changes in the cortex may be seen as early as the eighth day and translucency of the affected site

from the tenth to the fourteenth day of the disease. Soft tissue swelling, rarefaction, necrosis, sequestration, involucrum formation and sclerosis are later developments.

The course of the disease is determined by the virulence of the causative organism, the natural resistance of the patient and the effectiveness of the treatment. With the time-honored treatment of preserving immunity, surgical drainage of localized abscesses, immobilization, and delayed sequestrectomy, the author completely concurs. The real point of this article is to emphasize that with modern hospital facilities, earlier diagnosis, and more accurate intensive specific treatment, the natural course of the disease will be altered with shortening and lessening of its ravage. This can probably be best illustrated by the following case reports.

CASE REPORTS

Case 1.—Acute hematogenous osteomyelitis of the ilium.—A sailor, 22 years of age, was admitted to the Naval Hospital at Alca Heights complaining of pain in the right buttock with radiation down the sciatic nerve following a toothache a few days previously. Signs of early sepsis were present but no localizing symptoms were evident except tenderness over the buttock. Penicillin 50,000 units every 3 hours was begun without an accurate diagnosis. When seen by the orthopedic consultant, a blood culture was performed and the penicillin continued. Roentgenographic examination, including an intravenous pyelogram, was negative except for obscuration of the right psoas shadow.

Two days later the sepsis has become more profound with a temperature of 104° F., pulse 120, and leukocyte count of 23,000 with 90 percent polymorphonuclears. At this time the blood culture was reported positive for hemolytic *Staphylococcus aureus* which was inhibited by both penicillin and streptomycin on plating tests. The penicillin dosage was increased to 100,000 units every 3 hours. On the third day of hospitalization the hip was aspirated anteriorly with negative results, but tenderness over the sacro-iliac joint led to exploration with an aspiration needle. Ten cubic centimeters of thick pus was obtained and submitted for culture.

Treatment consisted in the instillation of penicillin 200,000 units and streptomycin gram 1 through the aspirating needle into the abscess cavity which was superior to the sciatic notch on the ilium. A long spinal needle with the point placed at this site was inserted from the side of the buttock and was secured with adhesive tape. Through this needle into the gluteal muscle and abscess site, 1,000,000 units of penicillin with 10 cc. procaine 1 percent and 1,000 cc. saline was administered by continuous drip in each 24 hours. Aspiration and instillation of penicillin and streptomycin was performed every other day until no further pus could be aspirated. Transfusions of blood and plasma were administered repeatedly to maintain the erythrocyte count and serum proteins. Fluid and electrolyte balance were maintained by parenteral fluids and a high protein diet with supplementary vitamins was prescribed.

Blood cultures were found to be repeatedly positive on the fifth and seventh days of the illness in spite of heavy dosage of antibiotics. Thereafter, however, on this regime the patient gradually improved and became afebrile in about 2 weeks. At this time roentgenograms showed an area of translucency in the right ilium adjacent to the sacro-iliac joint. Penicillin therapy was continued and the patient remained afebrile although up in a wheel chair. At the end of 5 weeks

he was evacuated to the mainland with the recommendation that he be continued on penicillin for at least another month.

Comment: This case illustrates the remarkable virulence of the infecting organism which maintained a bacteremia for at least 7 days in spite of heavy dosage of antibiotics to which it was susceptible by plating tests in vitro. Massive doses of antibiotics, supportive treatment with multiple transfusions and drainage of the abscess by repeated aspirations with instillation of a specific agent are believed to have arrested this very fulminating case of osteomyelitis of the ilium with a minimum of destruction.

Case 2.—Acute implantation osteomyelitis of the spine and tibia.—An officer 40 years of age was admitted to the hospital complaining of chronic low back pain and acute disabling sciatic radiculitis. Signs and symptoms were those of herniated intervertebral disc at the lumbosacral level. Treatment consisted in laminectomy, removal of the bulging intervertebral disc and spinal fusion utilizing bilateral tibial grafts placed across a prepared bed from L-4 to the sacrum. The sciatic radiating pain was relieved immediately and the postoperative condition was good.

On the fifth postoperative day, however, in spite of penicillin prophylaxis, signs of sepsis appeared. Localization of the infection was not apparent but culture of the tibial donor site and blood culture were performed. On the tenth day fluctuation was noted over the left paravertebral area. Aspiration away from the midline incision which had healed primarily revealed thick yellow pus which was also cultured. All these cultures, the blood, the spine, and the tibia revealed a gram-negative rod which was not inhibited by penicillin but which was inhibited by streptomycin.

Treatment consisted in repeated aspiration of pus from the back and instillation of streptomycin grams 2 into the abscess cavity, and the systemic administration of streptomycin grams 2 daily. Repeated transfusions and parenteral fluid were given. On this program sepsis gradually disappeared. Both surgical incisions healed primarily. No sequestration occurred but subsequent roentgenograms revealed the complete absorption of the graft on the left. At the end of 4 months solid bony fusion was present and the patient gradually became ambulatory without leg or back pain.

Comment: This case demonstrates the value of determining the susceptibility of the causative organism after it has been isolated by culture. Surgical calamity was salvaged to accomplish an acceptable result in the face of a severe implantation osteomyelitis of the spine and tibia.

Case 3.—Chronic osteomyelitis of the femur with a draining sinus.—A sailor 20 years of age was admitted complaining of a draining sinus intermittently present for 3 years following an attack of hematogenous osteomyelitis. Spontaneous rupture had occurred with little treatment of the acute stage.

Physical examination revealed an ambulatory youth in no distress. A draining sinus was found opening at the site of the right femoral adductor tubercle. Probing and roentgenographic examination after lipiodol injection showed the sinus to communicate with an area of bone rarefaction 3 by 5 cm. on the posterior medial aspect of the distal third of the femur. Culture of the sinus

drainage showed the organism to be *Staphylococcus aureus* whose growth was inhibited by both penicillin and streptomycin.

Treatment consisted in the complete excision of the sinus tract and the area of infected femur. All grossly discernible pathological tissue was removed and the wound was closed without drainage after first having placed and secured a catheter through a stab wound in the opposite side of the leg. Through this catheter penicillin 1,000,000 units daily was administered by continuous drip directly into the site where the osteomyelitic focus had been removed. Excess penicillin solution was absorbed as a hypodermoclysis for maintenance of systemic penicillin level.

Healing occurred primarily and no febrile reaction occurred. When urticaria developed streptomycin by the intramuscular route was substituted for the penicillin drip. Weight bearing was prohibited because of the marked weakening of the femoral shaft by the bone resection, but the patient was gradually allowed up on crutches and was evacuated after 6 weeks treatment and observation, apparently healed of all evidence of infection. Bone graft to fill the defect could possibly have been done at this time but was deferred.

Comment: This case demonstrates that radical extirpation of diseased osteomyelitic tissue and primary closure can be effected in selected cases with the aid of massive dose chemotherapy.

Case 4.—Chronic osteomyelitis of the tibia—recurrent Brodie's abscess.—A sailor 23 years of age was admitted to the hospital complaining of intermittent swelling and redness of the right ankle for a period of 3 years. No acute episode was recalled.

Physical examination revealed a swollen, slightly tender, and slightly reddened right lower tibial region. Systemic signs were absent. Laboratory reports were not remarkable. Roentgenograms showed an area of rarefaction, cystic in character, 2 by 4 cm. in size in the distal tibia.

Treatment consisted in heat, rest, and elevation of the foot until the sub-acute symptoms subsided. Because of its recurrent nature exploration was then performed by decorticating the overlying bone and carefully removing by chisel, rongeur, and curet all the abnormal appearing marrow. The cavity was then filled with iliac bone chips and packed with a mixture of fibrin foam and penicillin 400,000 units. A section of the later mixture was also placed in the donor cavity of the ilium. Both incisions were closed without drainage and a cast was applied to the leg. Penicillin 100,000 units was administered every 3 hours for 3 weeks.

Culture of the marrow cavity showed *Staphylococcus aureus* but the incisions healed primarily and remained closed for a period of 2 months' observation.

Comment: This case also demonstrates that active surgical extirpation of an infected bone focus may be accomplished with expectancy of primary healing in selected cases. The fibrin foam penicillin mixture is extremely useful for it combines hemostatic and bacteriostatic qualities of a substance to fill cavities and to prevent the formation of hematmata.

COMMENTS

Although the long-range outcome of these cases is uncertain, and the follow-up is admittedly grossly inadequate due to military transfer

of patients and surgeon, the striking immediate results in these cases seem to be sufficiently favorable to warrant certain conclusions:

1. Four cases of osteomyelitis healed primarily in the face of surgical procedures or acute bacteremia largely because of the massive dosage of specific antibiotics and adequate supportive treatment.

2. Minimum laboratory investigation requires repeated blood and wound cultures, followed by specific chemotherapeutic susceptibility tests to determine which agent best inhibits the organisms.

3. Massive doses of specific antibiotics systemically and locally should be administered instead of small doses without specificity. Treatment should be continued for long periods, months instead of days and weeks, to eliminate the danger of recurrence.

4. Streptomycin frequently inhibits the growth of organisms found in osteomyelitis and is a highly efficacious therapeutic agent in these cases.

5. The erythrocyte count, blood proteins, and electrolyte balance should be maintained by adequate repeated transfusions of blood, plasma, and fluids.

6. Surgical drainage should be performed when abscess formation occurs or when response to intensive specific chemotherapy is not forthcoming.

7. Complete extirpation of the diseased tissue with primary closures may be accomplished in selected cases of localized quiescent osteomyelitis with the aid of massive doses of chemotherapy and bacteriocidal coagulants.

8. With adequate early treatment it is believed that more cases of osteomyelitis may be cured by this plan of treatment than by older methods. Even if some failures occur the results are sufficiently encouraging to warrant the continued use of a method which markedly reduces the mortality and morbidity of the disease.

9. A combination of chemotherapy plus sequestrectomy and Orr treatment will be necessary in long-standing cases of extensive bone involvement.

BIBLIOGRAPHY

1. BEEKMAN, F.: Hematogenous osteomyelitis. In MURRAY, C. R., and BANCROFT, F. W.: *Surgical Treatment of the Motor-Skeletal System*. J. B. Lippincott Co., Philadelphia, Pa., 1945.
2. LEWIN, P., and SCHEMAN, L.: Osteomyelitis. *Surgical Clinics of North America* Vol. 27, No. 1, Feb. 1947.
3. ROBERTSON, I. M., and BARRON, J. N.: Method of treatment of chronic infective osteitis. *J. Bone & Joint Surg.* 28: 19-28, Jan. 1946.
4. STEINDLER, A.: *Post-graduate Orthopedic Lectures*. State University of Iowa, Iowa City, Ia., 1947.



HODGKIN'S DISEASE

JOSEPH R. CONNELLY
Lieutenant Commander (MC) U. S. N.

JAMES T. SMITH¹
Lieutenant (MC) U. S. N.

and

JOSEPH M. STRAUGHAN
Lieutenant (MC) U. S. N.

NIX (16) has defined Hodgkin's lymphogranulomatosis as "a chronic affection characterized by progressive painless enlargement of the [lymph] nodes, marked secondary anemia, profound cachexia and an invariably fatal termination." Ewing (6) expressed the opinion that the disease is of a neoplastic nature and that the inciting factor is an infection.

INCIDENCE

Hodgkin's disease is not extremely rare. According to Jackson and Parker (10), approximately 0.25 percent of all persons who die in a hospital die of this disease. The incidence of the disease as determined at necropsy is shown in table 1. According to most authors, the disease is approximately twice as common among males as it is among females (table 2). Although the disease may occur at any age, it appears to occur most frequently during the second, third, and fourth decades of life (table 3). Unlike epithelial tumors, the more malignant forms of Hodgkin's disease are observed among older persons.

PATHOLOGY

The disease involves the reticulo-endothelial system. Table 4 shows the site of primary involvement in a group of cases reported by Jackson and Parker (11).

Jackson and Parker (10) have divided Hodgkin's disease into three types: (1) Hodgkin's paraganuloma, (2) Hodgkin's granuloma, and (3) Hodgkin's sarcoma. According to these authors, "Hodgkin's paraganuloma bears little or no resemblance to a true tumor, either in its histologic picture or its clinical course. The often scattered, isolated Reed-Sternberg cells, the lymphocytic infiltration with or without destruction of the lymph follicles and the complete lack of invasiveness all bespeak an infectious process, as do the comparatively

¹ Resigned 1 May 1947.

TABLE 1.—Incidence of Hodgkin's disease at necropsy

Authors	Number of necropsies	Incidence of Hodgkin's disease	
		Number	Percent
Jackson and Parker (10).....	16, 773	35	0.21
Davies (5).....	2, 473	8	.32
Barron (1).....	7, 253	24	.32
Symmers (20).....	8, 485	14	.16

TABLE 2.—Incidence of Hodgkin's disease according to sex

Author	Cases	Sex of patients			
		Male		Female	
		Number	Percent	Number	Percent
Oakey (17).....	52	36	70	16	30
Wallhauser (22).....	1, 447	1, 009	70	438	30
Gilbert (7).....	77	38	50	39	50
O'Brien (18).....	60	41	68	19	32
Jackson and Parker (10).....	38	27	71	11	29
Higley and Hauser (8).....	85	60	70	25	30
Mills and Prichard (15).....	20	15	75	5	25
Schultz (19).....	179	97	54	82	46
Total.....	1, 958	1, 323	67	635	33

TABLE 3.—Incidence of Hodgkin's disease according to age

Author	Cases	Age, years									
		0-9		10-19		20-29		30-39		40-49	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gilbert (7).....	77	1	1.3	7	9.1	28	36.4	21	27.3	10	12.9
Watt (23).....	201	16	8.0	35	17.4	61	30.3	38	18.9	27	13.4
Longcope and McAlpin (13).....	¹ 111	21	19.1	27	24.5	25	22.7	20	18.2	8	7.3
Longcope (12).....	² 150	22	14.7	31	20.7	29	19.3	35	23.3	16	10.7
MacNalty (14).....	.....	.....	15.4	.....	18.0	.....	33.3	.....	18.0	.....	10.2
Oakey (17).....	52	1	1.9	6	11.6	10	19.2	10	19.2	9	17.3
Uddströmer (21).....	536	.....	6	.....	9	.....	24	.....	19	.....	14

Author	Cases	Age, years									
		50-59		60-69		70-79		80-89		90-99	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gilbert (7).....	77	4	5.2	4	5.2	2	2.6	.....	.....	.....	.....
Watt (23).....	201	15	7.5	7	3.5	2	1.0	.....	.....	.....	.....
Longcope and McAlpin (13).....	¹ 111	6	5.5	2	1.8	.....	.....	.....	.....	.....	.....
Longcope (12).....	² 150	9	6.0	4	2.7	0	0	1	0.7	.....	.....
MacNalty (14).....	.....	.....	5.1	.....	.....	.....	.....	.....	.....	.....	.....
Oakey (17).....	52	11	21.2	3	5.8	1	1.9	0	0	1	1.9
Uddströmer (21).....	536	.....	14	.....	11	.....	3	.....	.....	.....	.....

¹ Age not given in 2 cases.² Age not given in 3 cases.

TABLE 4.—*Site of primary involvement according to type of lesion*¹

Type of lesion	Site of primary involvement	Cases
Hodgkin's paraganuloma (26 cases).	Cervical lymph nodes.....	23
	Inguinal lymph nodes.....	2
	Axillary lymph nodes.....	1
Hodgkin's granuloma (59 cases).....	Retroperitoneal lymph nodes.....	17
	Para-aortic lymph nodes.....	13
	Mediastinal lymph nodes.....	9
	Cervical lymph nodes.....	8
	Mesenteric lymph nodes.....	6
	Stomach.....	3
	Duodenum.....	1
	Small intestine.....	1
	Large intestine.....	1
	Retroperitoneal lymph nodes.....	19
Hodgkin's sarcoma (27 cases).....	Stomach.....	3
	Tonsil.....	2
	Mediastinal lymph nodes.....	1
	Para-aortic lymph nodes.....	1
	Lung.....	1
	.....	1

¹ As reported by Jackson and Parker (11).

benign course and the fact that in almost all cases the disease starts in the lymph nodes of the neck, * * * In a previous article, Jackson (9) classified this type of the disease as "early Hodgkin's disease," and said:

There is neither fibrosis nor eosinophilia * * * The clinical course is usually slow. Indeed, the condition may remain entirely unaltered for as many as 20 years, yet from a study of our cases with multiple biopsies, we believe that, in some instances, the condition gradually passes over into classical Hodgkin's disease.

Hodgkin's granuloma, or classic Hodgkin's disease, is characterized by Sternberg-Reed cells, fibrosis, necrosis and eosinophilic infiltration.

In describing Hodgkin's sarcoma, Jackson said:

Typically the involved tissues are replaced by large cells of uniform size surrounded by a considerable amount of deeply basophilic cytoplasm. The nuclei are round and characteristically present a very prominent nucleolus. Some cells are multinucleated, and there are scattered typical Sternberg-Reed cells, without which a diagnosis cannot be made. The general appearance of the tissue is that of an embryoma or anaplastic carcinoma. Dead cells appear here and there, but there is neither fibrosis nor true necrosis. Neither polymorphonuclears nor eosinophiles are to be found. The disease runs a characteristically rapid course. Classical Hodgkin's disease may, at times, take on a sarcomatous nature and progress into this malignant form * * * Just as early Hodgkin's disease [Hodgkin's paraganuloma] may unquestionably, with the passage of time, take on the full characteristics of classical Hodgkin's disease, so the latter may suddenly become highly malignant, and excised tissue will show areas indistinguishable from Hodgkin's sarcoma.

SYMPTOMS AND CLINICAL TYPES

Gilbert and other authors have divided Hodgkin's disease into four clinical types; namely, acute, rapid, average, and slow. The acute form of the disease fortunately is rare. The onset of this form of the

disease is sudden. The temperature is high from the onset. The general condition of the patient is greatly altered and visceral manifestations are the rule. Death usually occurs in a few weeks.

Successive involvement of various groups of lymph nodes occurs quickly in the rapid form of the disease. Compression by the lesions produces complications in the extremities, pleural cavities, and abdomen. This form of the disease is resistant to all treatment. Death usually occurs within a few months.

In the average form the onset is insidious. One or more groups of lymph nodes become involved. The disease may be confined to one group of lymph nodes for some time. The disease proceeds intermittently. Remissions may occur spontaneously or they may be brought about by treatment. Activity of the disease may be indicated by fever and malaise. Eventually, the disease becomes generalized and cachexia develops. Compression may cause such complications as pleural effusion, ascites, icterus, and edema. Death may be due to secondary anemia. Death always occurs within 10 years after the onset of the disease; the average duration of the disease is 2 years.

In the slow form, the progress of the disease is almost imperceptible except when the patient is observed for several years. Even without treatment, patients may live for 20 years after the onset of the disease. An unknown stimulus may cause the lesions to assume the characteristics of the acute form of the disease.

In the group of cases reported by Gilbert, the type of the disease was as follows: acute or rapid in 20 percent, average in 60 percent, and slow in 20 percent.

TREATMENT

Surgical treatment.—Before roentgen therapy had attained its present high efficiency, operation was performed rather frequently in cases of Hodgkin's disease. Yates and Bunting (24) (25) have described the treatment that they were employing in 1915–1917. An attempt was made to remove all sources of infection. They next excised all eradicable involved tissue by block dissection. If the lymph nodes of the neck were involved and it was difficult to separate the involved nodes from the internal jugular vein, the authors excised this vein if there was no question regarding the patency of the corresponding vein on the opposite side. Roentgen therapy was employed within a few hours after operation and was repeated at frequent intervals. If the recurrent lesions appeared to be chronic, they were removed as soon as possible. In addition to the combined use of operation and roentgen therapy, the authors administered arsenic in the form of salvarsan or solution of potassium arsenite. The authors expressed the opinion that this type of treatment possibly might result in recovery in 20

percent of cases of the type of the disease that had come under their observation.

At the present time, the indications for the surgical treatment are so rigid that this type of treatment rarely is employed. In considering the present status of surgical treatment, Craver (4) said:

If Hodgkin's disease appears to be positively limited to one accessible group of nodes it is probably justifiable to remove that group of nodes surgically, since such a procedure is seldom followed by local recurrence, provided it has been possible to perform a clean dissection. However, it would seem best to irradiate the field postoperatively and to give treatment also to contiguous lymph-node regions which may conceivably harbor latent granulomatous disease. While patients for whom such procedures are carried out may seem to remain free from further manifestation of the disease longer than they may have been expected to do otherwise, yet there is no reason to believe that they will be spared from eventual generalization.

It is of little practical importance to dilate further upon this point, because patients actually suitable for such procedure are very few. The great majority of patients with Hodgkin's disease present evidence of the process in more than one lymphatic region when the diagnosis is first established.

In considering the treatment, O'Brien (18) said:

Surgical excision of localized nodes and without irradiation seems definitely to have influenced the duration of life of some cases of genuine Hodgkin's disease.

Oakley (17) said that large masses of involved nodes may be removed to eliminate pressure symptoms and that operation may be performed for cosmetic effect if desired by the patient.

Roentgen therapy.—In considering the treatment of Hodgkin's disease with roentgen rays, Gilbert (7) said:

The most desirable dose should be the smallest total dose capable of destroying all the granulomatous tissue without jeopardizing the patient's general condition or the condition of his blood.

Experience has condemned small doses given at intervals (weekly, for example), repeated for a long time, directed only to the most apparent manifestations, and without a general plan. It has also condemned massive doses given at one sitting. Since 1920, it has pointed toward fractional doses, given at short intervals and with a total dose sufficient to maintain their activity. This idea of strong but fractional doses has gradually won over almost all therapeutic radiologists.

Teleoroentgen therapy, with its indiscriminate irradiation of the whole hemolytopoietic system, is likely to produce deleterious systemic reaction and severe anemia. According to Gilbert, "Total roentgen therapy in malignant granulomatosis should be eliminated." Craver (2) said:

In Hodgkin's disease irradiation of the entire body is used at Memorial Hospital only in small doses in selected cases and as a supplement to local irradiation. One cannot expect the body to tolerate enough exposure to radiation distributed simultaneously over its whole surface to produce satisfactory regression of bulky masses of granulomatous tissue.

In considering regional roentgen therapy, Gilbert (7) said:

In segmental roentgen therapy, three conceptions have gained adherents:

A. To irradiate only the clinical manifestations, and to avoid with care parts of the lymphatic system which appear to be healthy (Voorhoeve, Kruchen).

B. Wide irradiation of the regions patently invaded, as well as regions suspected of invasion (Bowling, Desjardins, Gilbert, Schwarz, and others).

C. To irradiate the entire trunk, including the cervical and inguinal regions (Chaoul and Lange).

Roentgenologists agree that the technic and dose employed should be governed by the site of the lesions and the response of the patient.

In evaluating the results of irradiation in cases of Hodgkin's disease, Craver (4) said:

Entirely aside from the question of length of survival, when one considers the dramatic primary regressions and the alleviation of symptoms brought about by irradiation in the majority of patients the continued use of x-ray and radium is fully justified.

Medical treatment.—General supportive treatment, including a high caloric diet, should be employed. Among the measures that have been recommended are rest in bed, heliotherapy, hematinics, and blood transfusions. Many authors administer arsenic between courses of roentgen therapy.

PROGNOSIS

According to Jackson (9), the prognosis varies in different cases. He said: (1) that patients who have Hodgkin's sarcoma do not live more than 3 years after the appearance of the initial symptoms, (2) that patients with classic Hodgkin's disease never live more than 10 years, and (3) that an appreciable number of patients who have an early stage of the disease live 10 years or more.

Gilbert, of Switzerland, reported a 5-year survival rate of 34 percent but this figure is much higher than that reported by other authors; in fact, it has been seriously challenged by O'Brien. Craver (3), who reported a five year survival rate of 17 percent, said that Gilbert's material must have included a comparatively large number of cases in which the disease was in an early stage of development. In this connection it is interesting to note that Gilbert said:

The average duration of survival in my cases has been favorably influenced by a fortunate proportion of moderate evolutionary forms, * * *.

In concluding his article, O'Brien (18) said:

* * * I find no evidence that irradiation has influenced the average duration of life of patients as a group with Hodgkin's disease. Some apparently destined to have the disease for a long time have lived for periods of 10 to 25 years following surgery, irradiation, or a combination of both. Irradiation is definitely life saving for some and helps others live in comparative comfort for years. That it transforms a malignant morbid process into one that is benign, thus

doubling or trebling the life expectancy of those with the disease as has been suggested does not appear tenable.

In general, it may be said that the acute form of the disease, which corresponds to the sarcomatous type of Jackson and Parker (10), runs a rapid course and death occurs in from a few weeks to a few months after the onset of the disease. In the average or classic type, which corresponds to the granulomatous type of Jackson and Parker, death occurs in from a few months to ten years, the average duration being 2 years. In the benign or slow evolutionary type, which corresponds to the paragrulomatous type of Jackson and Parker, death usually occurs in from 6 to 20 years but in exceptional cases the patients may live even longer.

CASE REPORT¹

A sailor, aged 28 years, was admitted to the hospital on May 16, 1945 because of a swelling below the right side of the mandible. Seven years previously, the patient had had anemia and had been successfully treated with liver therapy. The swelling below the mandible had begun 3½ months before the patient was admitted to the hospital. The tumor was freely movable. It had increased in size progressively but had not been tender or painful. The patient had lost 15 pounds (6.8 kg.) in 6 months. When the patient was admitted to the hospital his temperature was 99.2° F., his pulse rate was 90, his respiratory rate was 18, and his blood pressure was 135 mm. of mercury systolic and 70 mm. diastolic. The leukocyte count was 10,000, the erythrocyte count was 4,850,000 and the value for the hemoglobin was 14 gm. per 100 cc. of blood. A differential blood count revealed 77 percent polymorphonuclear neutrophils and 23 percent lymphocytes. Kahn's test did not disclose any evidence of syphilis. Roentgenographic examination did not reveal any obstruction of Wharton's duct. The clinical diagnosis was a mixed tumor of the right submaxillary gland.

The tumor, together with the adjacent fat and lymph nodes in the submaxillary triangle was excised. The tumor measured 4 by 4 by 2.5 cm. Pathologic examination of the submaxillary gland did not disclose any neoplasm. Microscopic examination of the lymph nodes revealed moderately advanced lymphoblastoma. The wound healed satisfactorily but 10 days after the operation the patient still had a low-grade fever. Roentgenographic examination disclosed multiple minute regions of calcification in the hilus of the right lung.

Clinical and roentgenographic examination indicated that the disease was localized in the right side of the neck. Five weeks after excision of the tumor, the lymph nodes along the jugular vein and carotid artery were excised with some of the surrounding fascia. All of the lymph nodes were enlarged and firm, and on gross examination sections of the nodes had the appearance of fish flesh. The pathologist who examined these lymph nodes made a diagnosis of "lymphoma—probably Hodgkin's disease." (This finding bears out the statement of Jackson that one type of Hodgkin's disease may proceed to another.) Roentgen therapy was employed subsequently.

SUMMARY

Hodgkin's disease is a chronic affection characterized by progressive enlargement of the lymph nodes, severe secondary anemia and pro-

¹ Work done while under instruction in surgery at a United States Naval Hospital.

found cachexia. The disease is invariably fatal. The incidence of the disease as determined by necropsy varies from 0.16 to 0.32 percent. It is approximately twice as common among males as it is among females. It occurs most frequently during the second, third, and fourth decades of life. Jackson and Parker (10) have divided the disease into three pathologic types: (1) paragranuloma, (2) granuloma, or classic Hodgkin's disease, and (3) Hodgkin's sarcoma. Gilbert has divided the disease into four clinical types: (1) acute, (2) rapid, (3) average, and (4) slow. If the disease appears to be limited to one group of lymph nodes, it may be advisable to excise that group of nodes. In the great majority of cases, there is evidence of involvement of more than one group of lymph nodes when the diagnosis is made. Roentgen therapy will produce symptomatic relief but it apparently does not prolong life.

REFERENCES.

1. BARRON, M.: Unique features of Hodgkin's disease (lymphogranulomatosis) with report of 3 unusual cases and summary of 24 cases studied at necropsy. *Arch. Path. & Lab. Med.* 2: 659-690, Nov. 1926.
2. CRAVER, L. F.: Irradiation in lymphomatoid diseases. *Bull. New York Acad. Med.* 15: 442-445, July 1939.
3. CRAVER, L. F.: Discussion. In conference on therapy; treatment of Hodgkin's disease. *J.A.M.A.* 115: 298-299, July 27, 1940.
4. CRAVER, L. F.: Diseases of the lymphoid system: Hodgkin's disease, lymphosarcoma, leucemia, polycythemia vera. In PACK, G. T. and LIVINGSTON, E. M.: *Treatment of cancer and allied diseases*. Paul B. Hoeber, Inc., New York, N. Y., 1940. Vol. 3, p. 2487.
5. DAVIES, G. F. S.: Hodgkin's disease. *M. J. Australia.* 1: 199-212, Feb. 16, 1935.
6. EWING, J.: *Neoplastic Diseases*. 4th edition. W. B. Saunders Company, Philadelphia, Pa., 1940. p. 386.
7. GILBERT, R.: Radiotherapy in Hodgkin's disease (malignant granulomatosis); anatomic and clinical foundations; governing principles, results. *Am. J. Roentgenol.* 41: 198-241, Feb. 1939.
8. HIGLEY, C. S., and HAUSER, H.: Diagnosis, prognosis and treatment of Hodgkin's disease. *Ohio State M. J.* 35: 1075-1079, Oct. 1939.
9. JACKSON, H., JR.: Classification and prognosis of Hodgkin's disease and allied disorders. *Surg., Gynec. & Obst.* 64: 465-467, Feb. 1937.
10. JACKSON, H., JR., and PARKER, F., JR.: Hodgkin's disease; general considerations. *New England J. Med.* 230: 1-8, Jan. 6, 1944.
11. JACKSON, H., JR., and PARKER, F., JR.: Hodgkin's disease; pathology. *New England J. Med.* 231: 35-44, July 13, 1944.
12. LONGCOPE, W. T.: Hodgkin's disease. In OSLER, W., and McCRAE, T.: *Modern Medicine*. 3d edition. Lea & Febiger, Philadelphia, Pa., 1927. Vol. 5, chap. 7, pp. 226-259.
13. LONGCOPE, W. T., and McALPIN, K. R.: *Hodgkin's Disease*. Oxford medicine. Oxford University Press, New York, N. Y., 1920. Vol. 4, part 1, pp. 1-43.
14. MACNALT, A. S.: An investigation of lymphadenoma with relapsing pyrexia. Great Britain Ministry of Health Reports on Public Health and Medical Subjects. No. 50, 1928.

15. MILLS, E. S., and PRICHARD, J. E.: Clinical and pathological features of series of 20 cases of Hodgkin's disease. *Canad. M. A. J.* 33: 50-58, July 1935.
16. NIX, J. T.: Hodgkin's disease. *New Orleans M. & S. J.* 89: 648-651, May 1937.
17. OAKLEY, R. S., JR.: Review of 52 cases of Hodgkin's disease. *Hahneman. Monthly.* 79: 139-149, March 1944.
18. O'BRIEN, F. W.: End-results in irradiated Hodgkin's disease. *Am. J. Roentgenol.* 46: 80-88, July 1941.
19. SCHULTZ, E. G.: Quoted by GILBERT, R.
20. SYMMERS, D.: Clinical significance of pathological changes in Hodgkin's disease. *Am. J. M. Sc.* 167: 157-177, Feb. 1924; cont. 167: 313-339, March 1924.
21. UDDSTRÖMER, M.: On occurrence of lymphogranulomatosis (Sternberg) in Sweden, 1915-1931, and some considerations as to its relation to tuberculosis. *Acta tuberc. Scandinav. Suppl.* 1, pp. 1-225, 1934.
22. WALLHAUSER, A.: Hodgkin's disease. *Arch. Path.* 16: 522-562, Oct. 1933; 672, Nov. 1933.
23. WATT, W. L.: Hodgkin's disease and deep x-ray therapy. *Brit. M. J.* 2: 712-713, Oct. 10, 1936.
24. YATES, J. L., and BUNTING, C. H.: Rational treatment of Hodgkin's disease. *J.A.M.A.* 64: 1953-1961, June 12, 1915.
25. YATES, J. L., and BUNTING, C. H.: Results of treatment in Hodgkin's disease. *J.A.M.A.* 68: 747-751, Mar. 10, 1917.

ADDITIONAL REFERENCES NOT INSERTED IN THE TEXT

- BADIA, P. D.: Primary Hodgkin's sarcoma of the jejunum with perforation, resection and radio therapy; case report. *Am. J. Surg.* 59: 577-584, Mar. 1943.
- BERNREITER, M.: Hodgkin's disease complicated by brucellosis. *J. Kansas M. Soc.* 43: 330-333, Aug. 1942.
- CRAVER, L. F.: Five year survivals in lymphatic tumors. *Surg., Gynec. & Obst.* 60: 485, Feb. 1935.
- CRAVER, L. F.: Local and general irradiation in Hodgkin's disease. *Radiology.* 31: 42-47, July 1938.
- CUTLER, M., and BUSCHKE, F.: *Cancer.* W. B. Saunders Company, Philadelphia, Pa., 1938.
- DESJARDINS, A. U., and FORD, F. A.: Hodgkin's disease and lymphosarcoma; a clinical and statistical study. *J.A.M.A.* 81: 925-927, Sept. 15, 1923.
- LANGER, H.: Roentgen therapy in hyperplastic blood dyscrasias; new technique for myeloid and lymphatic leukemia, polycythemia rubra vera and Hodgkin's disease. *Am. J. Roentgenol.* 34: 214-231, Aug. 1935.
- MEYER, O. O.: Some therapeutic experiences with Hodgkin's disease. *J. A. M. A.* 117: 595-599, Aug. 23, 1941.
- O'BRIEN, F. W.: Roentgen treatment of the so-called malignant lymphomas. *J.A.M.A.* 107: 2022-2025, Dec. 19, 1936.
- PETT, R. G.: Irradiation of cutaneous manifestations of lymphoblastoma. *Pennsylvania M. J.* 42: 387-391, Jan. 1939.
- POHLE, E. A.: *Clinical Roentgen Therapy.* Lea & Febiger, Philadelphia, Pa., 1938.
- ROSENTHAL, S. R.: Significance of tissue lymphocytes in the prognosis of lymphogranulomatosis. *Arch. Path.* 21: 628-646, May 1936.
- SMITH, L. W., and GAULT, E. S.: *Essentials of pathology.* D. Appleton-Century Company, 1942. p. 290.
- Special article. Conference on Therapy: Treatment of blood disorders; IV. Roentgen therapy. *J.A.M.A.* 114: 2451-2456, June 22, 1940.

Special article. Conference on Therapy: Treatment of blood disorders; IX. Polycythemia, Hodgkin's disease and splenic disorders. J.A.M.A. 115: 297-302, July 27, 1940.

URBACK, E.: Lymphogranulomatosis (Hodgkin's disease); treatment with sulfanilamide. Arch. Dermat. & Syph. 41: 181-182, Jan. 1940.

VIETA, J. O.; FRIEDEL, H. L.; and CRAVER, L. F.: A survey of Hodgkin's disease and lymphosarcoma in bone. Radiology. 39: 1-14, July 1942.

WISE, B.: The sedimentation rate in Hodgkin's disease. J. Lab. & Clin. Med. 27: 1200-1206, June 1942.

WOLPAW, S. E.; HIGLEY, C. S.; and HAUSER, H.: Intrathoracic Hodgkin's disease. Am. J. Roentgenol. 52: 374-387, Oct. 1944.



ANESTHESIA ACTIVITIES ABOARD U. S. S. "BENEVOLENCE"

DAVID G. CLARK
Commander (MC) U.S.N.R.

SINCE commissioning, the U. S. S. *Benevolence* has been active, primarily, in servicing various units of the fleet. It is felt that the problems in anesthesia are representative of those which may be expected during peacetime Navy activities aboard a naval hospital ship. No injuries due to direct enemy action are included in the discussion. The review may be divided into three headings: the equipment, the personnel, and the types of anesthesia administered.



Figure 1.

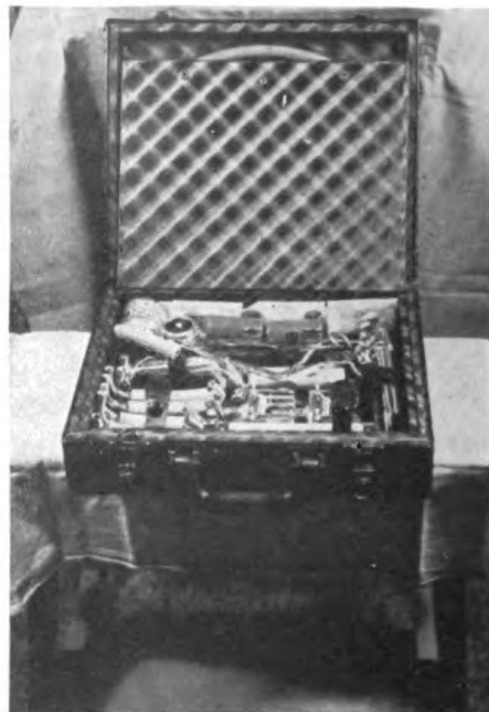


Figure 2.

*Figures 1 and 2.—The compact Lundy intratracheal set in its carrying case.
Available on Navy supply table.*

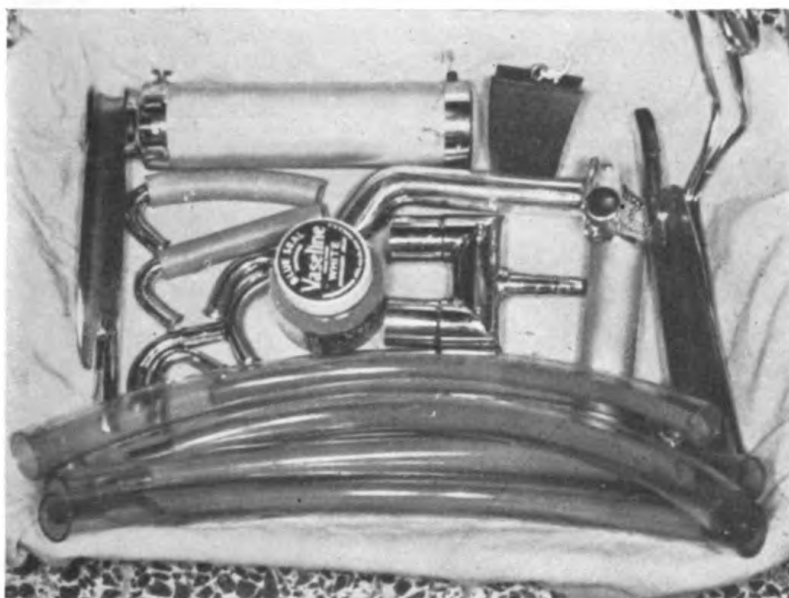


Figure 3.—Intratracheal tray as used aboard ship. The tray was kept complete and ready for instant use during operating periods.

EQUIPMENT

The entire ship is air conditioned which makes operating conditions pleasant and prevents accumulation of anesthetic gases. An anes-

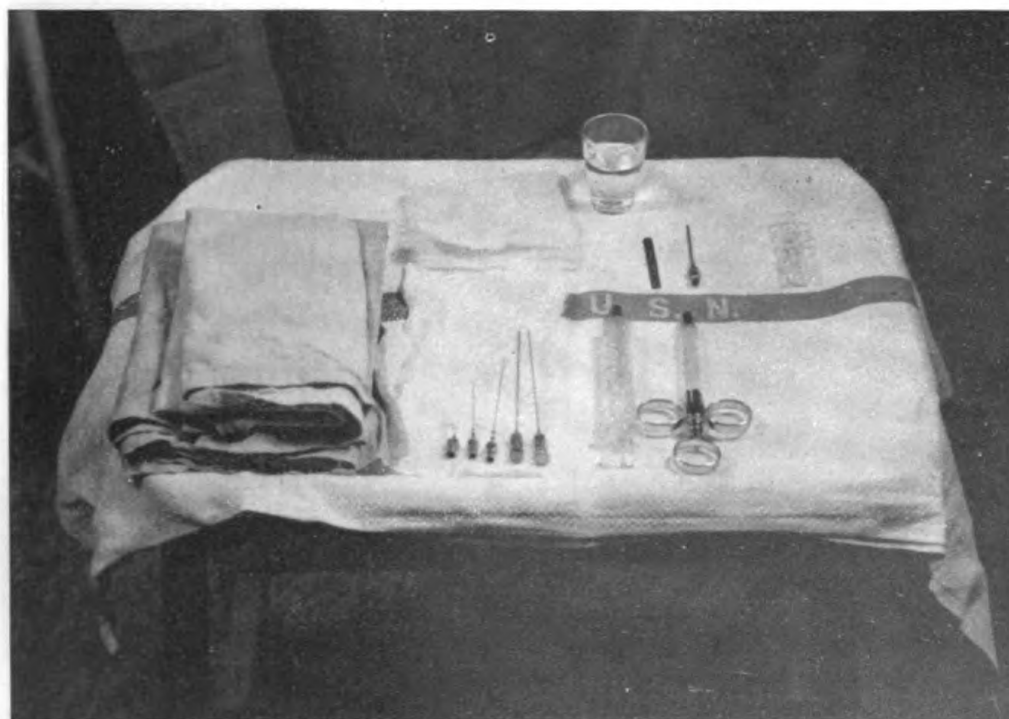


Figure 4.—Single dose spinal tray assembled from supply table items as used aboard ship.

775069°—48—4

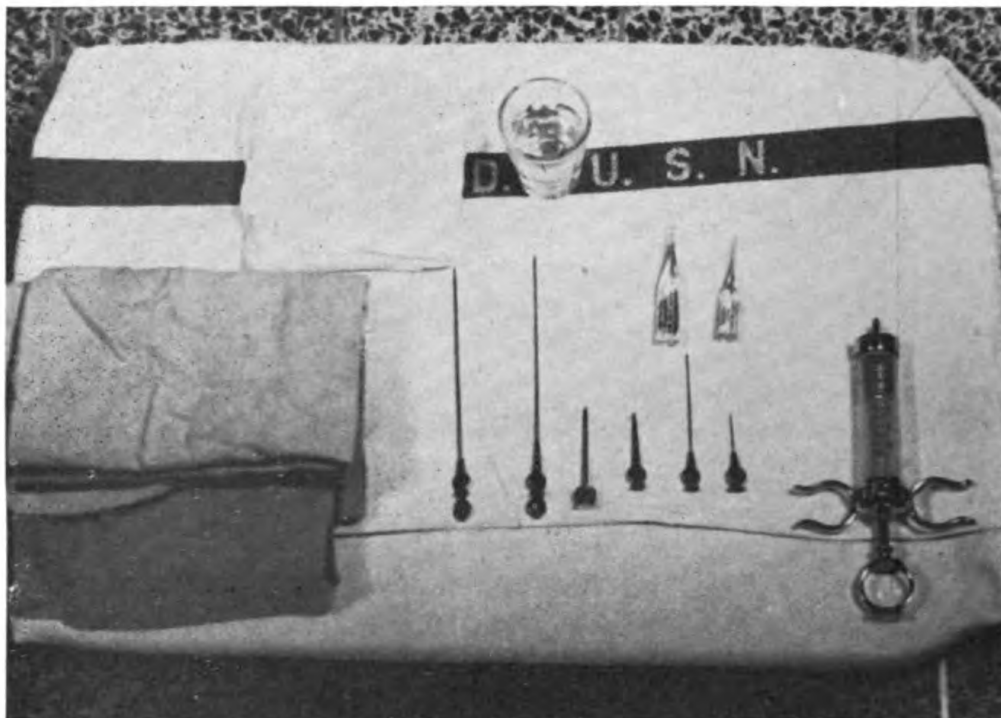


Figure 5.—Lundy spinal setup. Note the skin dilator and introducer next to spinal needles. Their routine correct use would greatly increase the percentage of successful spinals and reduce multiple punctures.

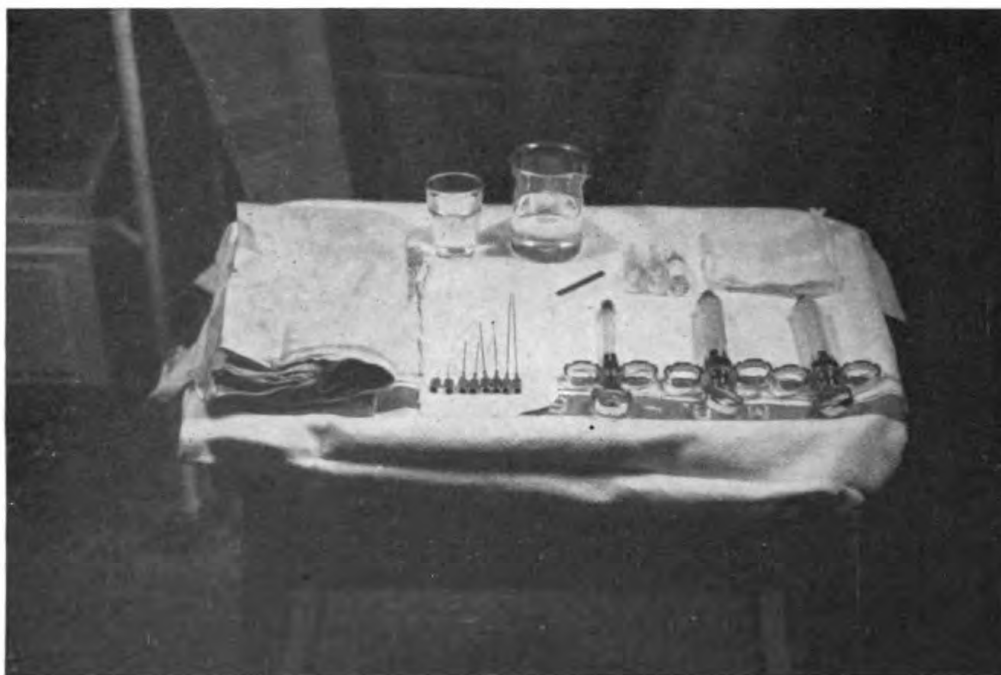


Figure 6.—Local block tray as used aboard ship. All items are available on the supply table and $\frac{1}{2}$ to 1 or 2 percent solution of novocaine with or without adrenalin is obtained by the proper dilution in sterile saline. Almost all the local blocks and infiltrations can be adequately performed from this tray. Caudal and transsacral block call for the addition of the caudal needle.

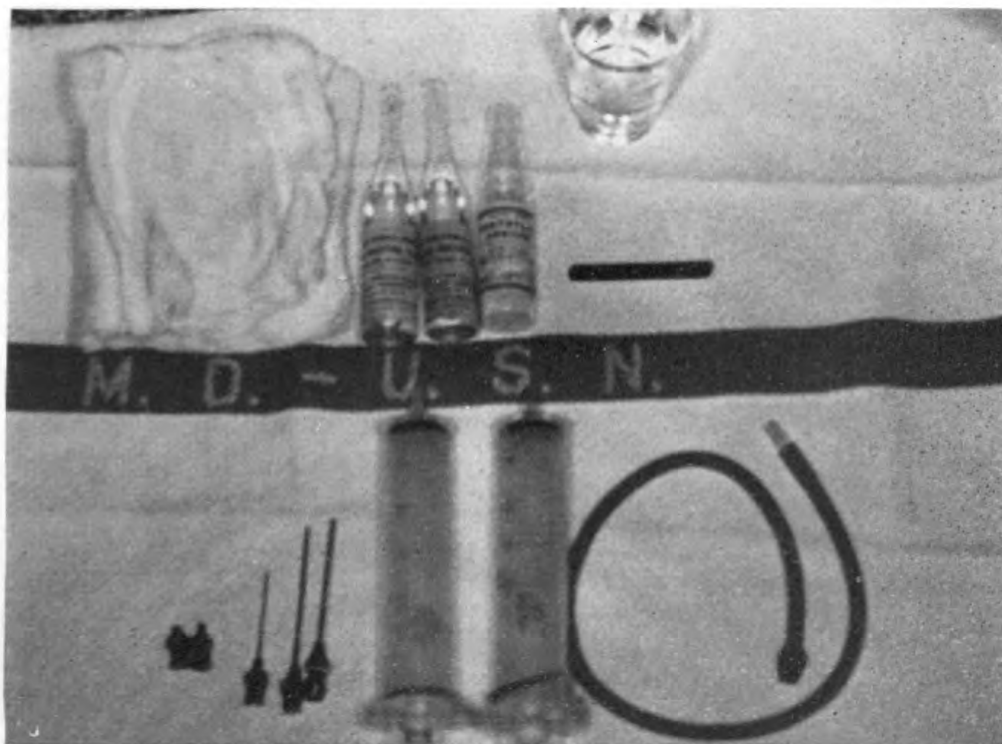


Figure 7.—Pentothal set. All items are standard except the tubing which is an ordinary piece of small intravenous tubing fitted with a needle hub at one end and a small glass adaptor at the other. The use of a hemostat prevents reflux of blood into tube and syringe and by the use of the tube the anesthetist may stay at the head of the patient to administer gas and/or oxygen and maintain the airway. The two needle hubs beside the needles are closed at their tips and are used to prevent loss of pentothal solution from extra syringes. Eccentric tip Luer-Lok 20-cc. syringes are ideal for intravenous anesthesia work and the standard types of pentothal tubing with stopcocks obviously more satisfactory. These items are difficult to obtain at present.

sia room is incorporated within the operating suite for use in induction, recovery, special procedures, and the stowage of gear. The major items of nonexpendable anesthesia equipment provided for two general, one orthopedic, and one EENT operating room are:

1. Two Heidbrink machines carrying N_2O , O_2 , CO_2 and He.
2. Two ether-vapor suction machines.
3. Two Lundy intratracheal sets (figs. 1, 2, and 3).
4. Two local anesthetic sets.
5. One continuous spinal set and mattress.
6. Three anesthesia tables.

Sets made up for spinal anesthesia (single dose and continuous), local infiltration, and nerve block, and for pentothal administration are shown in figures 4, 5, 6, 7, and 8.

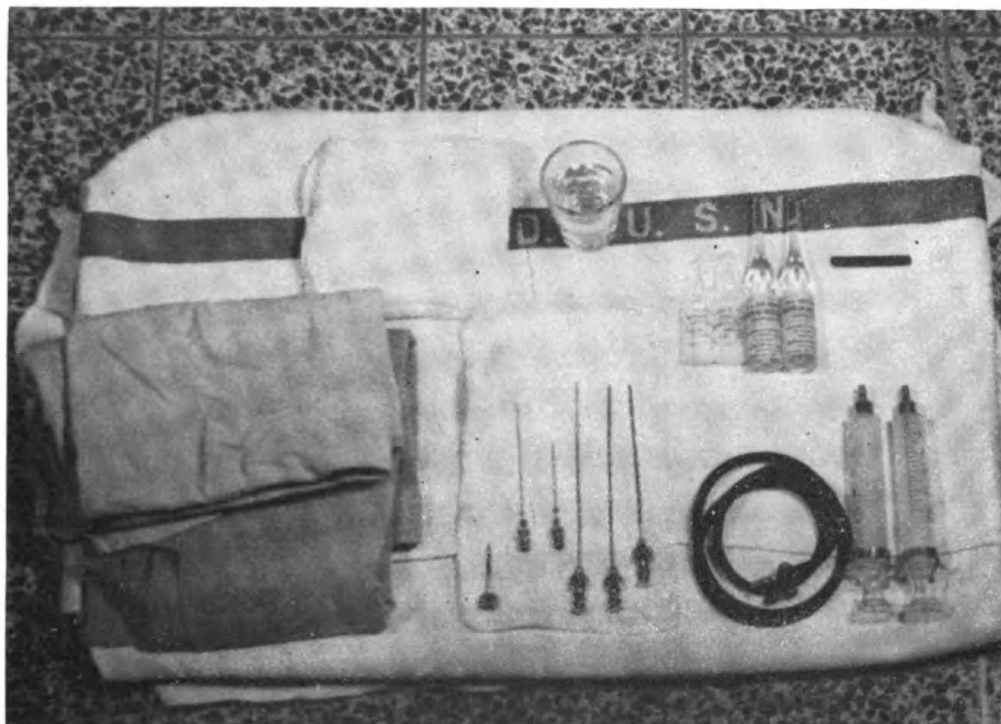


Figure 8.—Continuous spinal tray. Note the director which facilitates introduction of the malleable needle and minimizes damage to the soft bevel incurred by striking bone.

PERSONNEL

One nurse anesthetist and one medical officer in charge of anesthesia were assigned aboard. Both officers carried on other routine duties connected with surgery so that the conduct of anesthesia was essentially secondary.

TYPES OF ANESTHESIA

The anesthetics administered were as follows:

Inhalation:

Gas, oxygen, and ether without intratracheal.....	50
Gas, oxygen, and ether with intratracheal.....	14
Balanced N ₂ O, O ₂ and pentothal.....	18

Pentothal sodium intravenous.....	101
-----------------------------------	-----

Spinal anesthesia:

Single dose spinal.....	284
Continuous spinal.....	5

Local anesthesia.....	145
-----------------------	-----

This includes a few special blocks such as deep and superficial cervical blocks (2), brachial blocks (2), thyroid blocks (2), lumbar sympathetic block (1), blocks for saphenous and femoral vein ligation (3), caudal block (1).

Total anesthetics administered.....	¹ 617
-------------------------------------	------------------

¹ This excludes EENT operations performed under local.

Inhalation anesthesia.—General anesthesia was administered for intra-abdominal above the level of the umbilicus and for other procedures above this level unless satisfactory local or region anesthesia could be satisfactorily produced by other means. McGill intratracheal tubes were passed under direct vision where position might threaten the airway (kidney position) or where manipulation or traction could be expected to interfere with respiration or produce crowing (cholecystectomy, etc.). No intrapleural procedures demanding positive pressure anesthesia were encountered. On a few occasions nasal intratracheal tubes were passed in order that packing might be placed in the posterior pharynx and intraoral procedures carried out at leisure. In these cases the pharynx was cocaineized, induction carried out with pentothal and the anesthesia machine connected to the intratracheal tube after it had been passed by the nasal route. Packing the pharynx with doubled, moist gauze compresses was effective in preventing aspiration of blood and pus and produced an airtight connection maintaining bag pressure on the machine.

Routine cleansing of the pharynx by suction was practiced after every inhalation anesthetic and tracheobronchial toilet with catheter and suction was performed whenever intratracheal tubes were used.

Balanced anesthesia or the use of N_2O and O_2 in conjunction with pentothal was used whenever the operative time was expected to exceed 20–30 minutes or whenever the operation contemplated led the anesthetist to expect that more than 1.5 grams (total dosage) might be used. It was found that the administration of pentothal sodium alone to the average young adult male with the usual premedication of

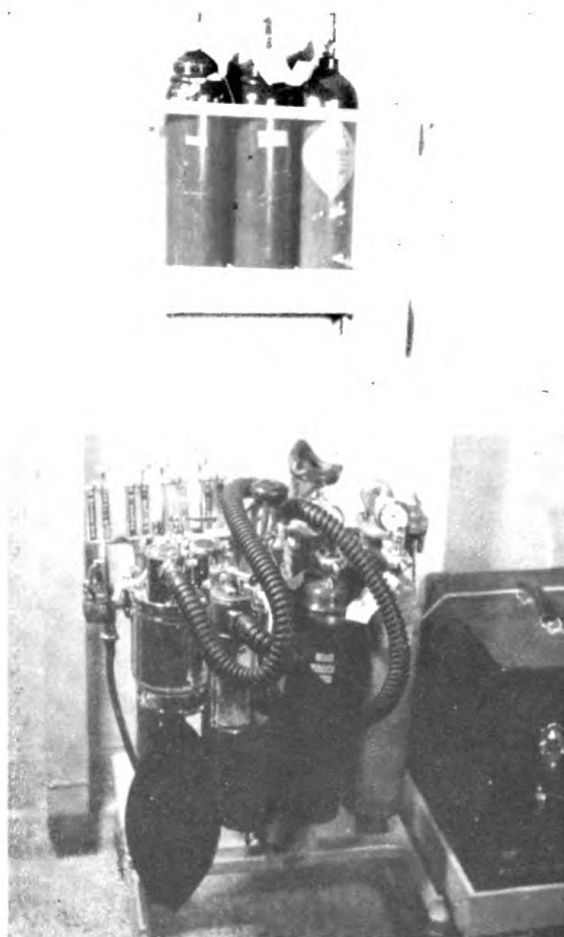


Figure 9.—Anesthesia machine secured to bulkhead of anesthesia room by metal clamps (not well shown). The head must be secured to the tank brackets to prevent swinging at sea and consequent damage to the head assembly. The method of securing extra tanks of gas is shown above.

morphine sulfate grain $\frac{1}{2}$ and atropine sulfate grain $\frac{1}{150}$ (h), came to 1.8 cc. per minute of operating time. In combination with N_2O and O_2 , either 50-50 or 60-40 (by volume) the amount of pentothal used was reduced to 0.93 cc. per minute. The balanced method thus reduced the total dose of pentothal, produced early return to consciousness and minimized risks involved in transporting the unconscious patient. To all intents and purposes this method presents the patient with the smooth and pleasant pentothal induction and the rapid recovery so typical of N_2O and O_2 . It was not attempted in intra-abdominal procedures or other operations demanding muscle relaxation. Every effort was made to obtain verbal responses from patients after general anesthetics before they were removed from the operating room and in cases where this could not be done without delay the "butterfly" of tissue paper and adhesive tape was applied from the nose to the chin to encourage observation of respiration. Where intratracheal tubes had been introduced they were allowed to remain in place until laryngeal reflexes returned. These precautions paid dividends in that no cases of cyanosis or postoperative airway obstruction were encountered.

Due to the fact that herniorrhaphies, appendectomies, excisions of pilonidal cysts, and rectal cases constitute such a large part of operative procedures in the fleet, spinal anesthesia assumes a correspondingly important position. The use of spinal was confined to procedures carried out below the level of the umbilicus because of the obvious dangers of the routine use of high spinal. Our preparations were limited to the 100 and 150 mg. ampules of novocaine crystals and the low spinal was found to be effective in the hands of a variety of anesthetists while producing a minimum of undesirable side effects. The needle was inserted between the third and fourth lumbar or between the fourth and fifth lumbar and the volume of fluid injected to $3\frac{1}{2}$ cc. or less. In addition to the usual doses of morphine and atropine, ephedrine sulfate, $\frac{3}{8}$ grain, was given intramuscularly 10 minutes before the spinal unless contraindicated by hypertension. Position change to vary the level of anesthesia was not used and the slightly hyperbaric solution (produced by dissolving the crystals in spinal fluid) was allowed to seek its own level with the patient in the supine position for 10 minutes before operation. The use of high spinal anesthesia produced by large volumes of fluid and greater amounts of anesthetic or by hypo- or hyper-baric solutions and position change must be left to the detailed supervision of highly trained anesthetists in every case or disaster will result.

Any spinal anesthesia with novocaine giving 45 minutes or more of anesthesia adequate for the operation performed was called satisfactory. 7.2 percent of the spinals administered by the medical officer and nurse anesthetist were unsatisfactory judged on this basis. The primary source of failure was malposition of the tip of the spinal

needle and in several cases free flow of cerebrospinal fluid was obtained both before and after injection of the anesthetic agent and still an unsatisfactory anesthetic was produced. It was presumed that in these cases part of the bevel remained extra-dural. There is little reason to doubt that the routine use of a director, with or without a skin awl or dilator, would materially reduce the percentage of spinal failures. Even with the malleable needle used in continuous spinals there was less difficulty in producing an entirely satisfactory puncture primarily because an introducer was always used. Without the resistance of the skin and the interspinous ligaments the penetration of the dura produces a distinct sensation so that by advancing the point slightly the anesthetist can be assured that the entire bevel is within the subarachnoid space. For a more authoritative discussion of these points John S. Lundy's book "Clinical Anesthesia"² may be consulted. Another factor that contributed to failure was the frequent difficulty encountered in obtaining a watertight connection between the spinal needle and the ordinary 10 cc. or 2 cc. glass syringe. Often in the struggle to produce a tight fit the tip of the needle would be moved and an extra-dural injection would result. 10 cc. and 3 cc. Luer-Lok syringes were somewhat more satisfactory but still cumbersome. The tapered bevel and simple locking device of the Lundy syringe obviates this difficulty.

Better back flexion of the patient about to undergo spinal anesthesia was obtained by placing one hand across the soles of the feet and one hand on the occiput, pulling the flexed knees up and head down. The knee-neck grip routinely advocated often prevents the patient from fully flexing rather than aiding.

Continuous spinal anesthesia was performed only five times with no failures and no complications. Novocaine or metycaine was used.

Local block was left in the hands of the surgeon with the exception of specialized procedures such as cervical, brachial, thyroid, sympathetic, and caudal blocks. The set assembled from the supply table is shown in figure 7. Adrenalin $\frac{1}{2}$ cc. of $\frac{1}{1000}$ per 100 cc. of solution was used in all local blocks except those of the digits where it was routinely avoided.

SUMMARY

A brief résumé of the permanent equipment, personnel, and anesthesia problems is presented, followed by a discussion of the types of anesthesia used and some of the difficulties encountered. It is felt that this small group may well represent the typical peacetime expectations of a similar ship or shore medical activity. Open purchase of a few additional items of equipment is suggested to minimize anesthetic failure in spinals.

² LUNDY, J. S.: *Clinical Anesthesia*. W. B. Saunders Company, Philadelphia, Pa., 1942.

A REVIEW OF PRESENT METHODS IN THE EARLY DIAGNOSIS OF BRONCHOGENIC CARCINOMA

HARVEY E. REITZ
Commander (MC) U. S. N.

THE INCREASING attention which is being paid to bronchogenic carcinoma has been due chiefly to the excellent results which are now possible with surgical treatment. In less than 15 years the techniques for potential cure have been developed to such a degree that a once hopeless condition can now be treated with gratifying results. It is not surprising, therefore, that so much emphasis is being put on early diagnosis; its importance and necessity need hardly be mentioned.

There is still some difference of opinion as to how much bronchogenic carcinoma is actually increasing in incidence. The majority of recent statistical studies, such as the one presented by Ochsner (1), give reliable evidence that the increase is absolute as well as relative. In any event, nearly 10 percent of all cancers in the male are bronchogenic in origin, being surpassed only by carcinoma of the stomach (2) (3). Findings in regard to age, sex, and other general features of the disease have been fairly constant among the various series of cases published. The age incidence is that of carcinoma in general, with the majority of cases occurring between 40 and 60. Hauser (4) has reported the condition of lung carcinoma in infants, which is sufficiently rare to be of no more than academic interest. The preponderance of men over women varies from 2 to 1 to 10 to 1; the average ratio appears to be about 5 to 1. The right bronchial tree is involved about twice as often as the left.

Etiology of bronchial cancer has been the subject of considerable investigation and speculation. The famous Schneeberg mine cases, in which radioactive, arsenic-laden dusts were incriminated, do not throw much light on the subject, since they represent a group unique in many respects. Horn (5) broke down his series of 45 cases in regard to occupation without noting anything significant. With a rising incidence in recent years, plus a preponderance of cases in males, it is not surprising that tobacco smoking has been seriously

considered as an etiologic agent. So far the evidence is no more than suggestive. Grace (6) cites Roffo's work in Argentina; he has isolated a carcinogenic substance—benzpyrene—from tobacco tar.

Classification of bronchogenic carcinoma on a histopathologic basis varies considerably with different investigators. Three types are usually described: squamous cell, adenocarcinoma, and undifferentiated carcinoma. The last is at times further subdivided into small cell and oat cell varieties. From the clinician's standpoint, a few facts are noteworthy. Squamous cell, or epidermoid, carcinomas constitute 40 to 50 per cent of these tumors, which is fortunate, inasmuch as they definitely are slower growing and slower in metastasizing than the other types (7) (2). However, Moersch and Tinney (8) found in a large series of cases that neither type nor grade of carcinoma appreciably altered the duration of life after diagnosis, which averaged 6 months. Jones (9) points out that biopsy tissue may differ histologically from that found when the tumor is removed; hence bronchoscopy biopsy does not necessarily offer an accurate basis for prognosis.

SYMPTOMS

The symptomatology of bronchogenic carcinoma has been subjected to statistical study by various writers. The one outstanding symptom is, of course, cough, occurring in 80 to 90 percent of cases. With minor variations, the five most common symptoms, all occurring in over 50 percent of cases, are as follows: cough and expectoration, weight loss, hemoptysis, chest pain, and dyspnea. Because of the differences in mode of onset, however, a set of symptoms based on statistical data is of no particular value as applied to the diagnosis of any given case. By and large, the symptoms are those associated with any pulmonary inflammatory condition, and definitely are not specific. The frequency of "pneumonitis" is noteworthy; in Moersch's series, half the patients had a diagnosis of pneumonia at some time during the course of their illness. Adams (7) makes this apt remark: "Symptomatology of carcinoma of the lung is largely explained by bronchial encroachment, with varying degrees of obstruction or ulceration of that organ." In those tumors of peripheral origin, which constitute approximately 25 percent of the whole, evidence of bronchial involvement may be minimal or nil. Not infrequently there is no history of symptoms referable to the chest; in the group of cases reported by Hochberg and Lederer (10), 21 percent were of such a type. These of course are practically never picked up early enough for successful treatment except by accident. The occasional discovery of such a case (along with other diseases of the lungs) is a valid argument for the use of routine chest photofluoroscopy as a public health measure.

Lung carcinomas of hilar origin rightfully receive the most attention because of their frequency (75 percent of the whole) and because they usually produce symptoms earlier. Overholt and Rumel (3) have divided the symptoms and signs into several stages from a clinico-pathological standpoint:

1. The stage before bronchial occlusion. This is a period of bronchial irritation with cough, first irritative, then productive; blood tinging is not infrequent.

2. The stage of bronchial occlusion. When partial, segmental emphysema may occur, and a wheeze may be present. As occlusion becomes complete, atelectasis develops. This is by far the commonest pathologic change giving rise to signs at an early stage.

3. Bronchial occlusion with secondary infection follows; recurrent pneumonitis, abscess, bronchiectasis, etc., may develop.

4. The stage of extension or metastases, at which time cure is patently impossible.

Physical signs in bronchial cancer are of value chiefly by inference, and will vary according to the type and extent of the overlying disease process. In early cases they are rarely definite enough to be of practical importance. In general, neither signs nor symptoms are sufficient to establish an early diagnosis, but serve only to warn the physician that bronchogenic carcinoma should be considered. Like many another disease of insidious onset and variable course, diagnosis is often missed because it is not thought of in time. It is rapidly becoming axiomatic to think of bronchogenic carcinoma in any patient with persistent or recurrent pulmonary symptoms, the cause of which are not definitely explainable on another basis.

DIAGNOSTIC AIDS

Because of the rapid and inexorable progress of the disease, a reasonable suspicion of its presence must be followed up by all available diagnostic aids which may be necessary to establish the diagnosis or to rule it out. It is of the utmost importance that such a follow-up be thorough; it should also be pervaded with a sense of urgency. A diagnosis confirmed by eventual metastasis or rib erosion is certainly of no more than academic interest.

The procedures which are on hand for aid in diagnosis of bronchogenic carcinoma are well known and, in the main, readily available.

1. Chest x-ray plays so much of a part in the diagnosis of this disease that it hardly can be considered as an "additional aid." On the ordinary posterior-anterior film, the two most common findings are unilateral infiltration of the hilum and atelectasis. Two thirds of a series of 206 proved cases reported by Olds and Kirklin (11) presented one or both of these findings. They point out that the amount of

atelectasis is not proportional to the size of the tumor, since complete bronchial obstruction can at times be caused by a relatively small mass. In a fairly large series reported by Overholt and Rumel (3) atelectasis was present in 85 percent of cases; in only 17 percent was the shadow of the tumor itself evident. A peripheral tumor may be confused with metastatic lesions; of aid in differentiation is the fact that the former, if early, is invariably solitary. Findings are at times those of the secondary lesion, such as lung abscess or pneumonitis. Jones (9) recommends tomography as a definite diagnostic aid in identifying the detail of certain masses not accessible to the bronchoscope.

2. Among more specialized procedures, bronchoscopy continues to head the list in importance and usefulness. Three fourths of the lung tumors are hilar in location; most of these are accessible to inspection and biopsy with the bronchoscope, or yield positive findings by inference, such as distortion or fixation of a bronchus. Information concerning extent and location of a tumor is important from the standpoint of operability; therapeutic benefits are also frequently obtained by drainage of infected material or in reestablishing an airway. Jackson and Konzelmann (12) point out that negative bronchoscopic findings may at times be of value by assuring the presence of an operable stump, should a pneumonectomy be indicated on the basis of other clinical findings. Adams (7) feels that bronchoscopy should not be used routinely when no especial help can be expected from it; he observes that a tumor mass casting a rounded shadow is almost invariably peripheral (i. e., not connected to a larger bronchus) even though it appears to be near the hilar structures. However, bronchoscopy is a relatively easy and quick procedure in the hands of a skilled operator, and it should be used early and often whenever reasonable suspicions indicate its need.

3. Sputum examination is concerned usually with ruling out tuberculosis in cases where that diagnosis must be entertained. Tumor cells are not demonstrable in sputum often enough to make the procedure of much value as a diagnostic aid. Of more promise is the examination of secretions obtained via the bronchoscope, as described by Herbut and Clerf (13). They were able to make a positive diagnosis by this method in an appreciable number of cases in whom bronchoscopy was otherwise negative. It appears that considerable experience with the specialized technique is necessary for reliable results.

4. In the presence of pleural effusions, thoracentesis may at times be of value in establishing a diagnosis. In those effusions caused by carcinoma, cancer cells may be demonstrated about 20 percent of the time. Such a finding, of course, rules out the possibility of operative cure.

5. Bronchography is a procedure of limited value in the diagnosis of bronchogenic carcinoma. Most writers agree that it should be done only after bronchoscopy has failed to yield positive findings. Farinas (14) describes a refinement in technique involving the use of uroselectan, a nontoxic organic iodine salt of low viscosity which readily passes stenotic lesions that would block lipiodol. More detailed information regarding the size, type, and extent of a bronchial growth is claimed for this method.

Several objections are commonly made to the routine use of bronchography. In cases of proved cancer, valuable time may be lost before operation can be attempted while lipiodol is being cleared from the lungs. As Jones (9) mentions, infections may be aggravated in those cases where retention of secretions is present.

6. Puncture biopsy as a diagnostic procedure has been roundly condemned by most authorities. Its dangers are fairly obvious; the most serious complication is extension of the tumor along the course of the puncture wound. Since associated infection is so often present, an empyema or extensive pneumonitis may also result.

7. Lymph node biopsy is worthy of mention. Adams (7) calls attention to the importance of careful search; he was able to confirm the diagnosis in 16.5 percent of his cases by this method. A fruitless operation may at times be averted, and in cases obviously inoperable, a diagnosis may be made quickly and easily if lymph node biopsy is positive.

8. Exploratory thoracotomy is rapidly increasing in stature as a most important diagnostic procedure. Thoracic surgeons in all parts of the country present statistical proof that the operation now carries a low mortality. Certain rules of conservatism naturally apply; diagnostic procedures of lesser magnitude should be carried out first, and the presence of metastases must be ruled out as far as is possible. Overholt and Rumel (3) bring out the important point that most carcinomas of the lung which cannot be proved by other means are peripheral in location; these are the very tumors which are most readily confirmed by exploration.

The indications for thoracotomy must be fairly liberal, but do not lend themselves well to tabulation. In a disease of such variable and at times indefinite nature, careful evaluation of each individual case must form the basis for the decision concerning surgical intervention. Certainly any case in which reasonable suspicion exists without confirmation by other means should be a candidate for early exploration, since under these circumstances the diagnosis will eventually be confirmed by the appearance of some inoperable complication, if cancer is actually present.

HOSPITAL CASES

Twenty-four cases of bronchogenic carcinoma were admitted to the U. S. Naval Hospital, Long Beach, Calif., from 1943 to May 1947. Of these, 18 were Veterans' Administration patients; 6 were active service personnel. The youngest patient was 18 years old, the oldest was 68. The average age was 50 years.

This series is too small to provide statistical data of any particular significance. However, certain facts are worthy of notice:

1. Eighteen of the twenty-four cases were obviously inoperable on arrival at this hospital.

2. In three more cases, subsequent findings (at operation or autopsy) proved the condition to have been inoperable on arrival.

3. Only 3 cases of the 24 (12.5 percent) arrived at this hospital at an early enough stage to have had a reasonable expectancy for operative cure.

4. Three cases of the group were subjected to exploratory thoracotomy; in none was pneumonectomy technically possible.

From a review of past records of these patients, the following conclusions were drawn: Of the 24 cases, 8 had an early course so silent or indefinite as to make an early diagnosis practically impossible. Six records were not complete enough to allow any conclusions. The ten remaining cases (42 percent) had symptoms of such a nature as to indicate that an early diagnosis could reasonably have been expected, had carcinoma been suspected and sought after vigorously.

It is of value at times to note in retrospect diagnostic errors and omissions that appear to have been avoidable. The case histories presented herewith are representative of the common pitfalls which so often forestall any hope of successful treatment in this disease.

CASE REPORTS

Case 1.—White male veteran, age 54. This patient was treated at U. S. Naval Hospital, Long Beach, from 10 Oct. 1946 to 7 Nov. 1946, with a diagnosis of primary atypical pneumonia, left base. He improved clinically, but chest x-rays at the time of his discharge revealed that a "minimal pneumonitis" was still present. He returned to the hospital on 28 Feb. 1947 complaining of continued loss of weight and strength, productive cough, and left lower chest pain. Moderate clouding was present in the left base on x-ray; bronchoscopy revealed a squamous cell carcinoma of the left main bronchus.

COMMENT

Nearly 50 percent of all cases of bronchogenic carcinoma have an episode of "pneumonia" at some time during their clinical course. It is of the greatest importance to follow such a case as this one long enough to be assured that resolution is complete. Had this patient not been permitted to drop out of sight, his carcinoma probably would have been diagnosed at an operable stage.

Case 2.—Naval medical officer, age 50 years. This patient became ill at a duty station outside the United States in May 1944. He was hospitalized at a naval hospital for a month where the diagnosis of lobar pneumonia, left lower lobe, was made. The illness was somewhat atypical. Two weeks after returning to duty, he developed fever, cough, blood-tinged sputum and discomfort in the left lower chest. He was admitted to another naval hospital in July 1944 where x-rays revealed an atelectasis of the left lower lobe. A medical survey board recommended immediate return to the United States for further investigation. He arrived at a third naval hospital (in the United States) in August 1944. Here, after further x-ray examinations, his diagnosis was changed to chronic pleurisy and he was sent on 30 days convalescent leave. Before this leave expired, he turned in at a fourth naval hospital because of recurrence of symptoms. Bronchoscopy was finally accomplished on 1 November 1944; carcinoma of the left lower lobe bronchus was found. The tumor was inoperable by this time. He was transferred to the U. S. Naval Hospital, Long Beach, for palliative treatment.

COMMENT

Such repeated division of responsibility in following a patient is not uncommon in military service. This case points out the importance of carefully checking all past history, both from the patient and from health record data.

Case 3.—White male veteran, age 49 years. Admitted to a civilian hospital on 17 January 1946 with the history of cough, mild hemoptysis, fever, and pain in the left upper chest for 2 weeks. Chest film revealed diffuse hazy opacity with a rounded lower margin in the left upper lobe. The idea of lung carcinoma was entertained. A lateral view x-ray revealed the density to extend from the posterior chest wall, and was interpreted by the roentgenologist as being "most consistent with a pleural encapsulation of fluid." After some clinical improvement, the patient went home on 30 January 1946. Five weeks later another chest film (in the out-patient department) revealed essentially the same findings. He turned in to the U. S. Naval Hospital, Long Beach, on 22 March 1946, with signs of obvious metastasis and died 10 days later. Autopsy revealed an extensive carcinoma originating in a left upper lobe bronchus.

COMMENT

The original clinical impression was swayed by a justifiable roentgenologic interpretation which nevertheless proved to be the wrong one. When a reasonable suspicion of lung carcinoma exists, every investigative procedure necessary to establish or rule out the diagnosis must be followed up.

Case 4.—White male veteran, age 28 years. First admitted to a U. S. naval hospital from 28 September 1946 to 29 October 1946 with a history of intermittent cough, precordial pain, dyspnea, and blood-streaked sputum of 18 months' duration, beginning after he was knocked down by concussion from an exploding shell. Chest film revealed "pneumonitis" in left base, extending from hilar region. Sputum was negative for tubercle bacilli. Upon clinical and x-ray improvement a diagnosis of atypical pneumonia was made. He returned to the hospital on 3 February 1947 with essentially the same symptoms, plus weight loss and wheezing respiration. Bronchoscopy revealed a concentric narrowing

of the left main bronchus extending to the carina; biopsy revealed squamous cell carcinoma.

COMMENT

This case illustrates the urgent necessity for investigating fully the cause of recurrent hemoptysis. Bronchoscopy at the time of his first admission would probably have established the diagnosis early enough for successful pneumonectomy.

Case 5.—White male veteran, age 53 years. This patient was admitted to the U. S. Naval Hospital, Long Beach, on 6 December 1946, with the history of a "chest cold" 7 months previously, followed by persistent productive cough, blood-tinged sputum, recurrent fever, night sweats, and weight loss of 25 pounds. Chest x-ray on admission revealed slight thickening of the right hilar shadow. Several more x-rays were obtained, and the patient was not bronchoscoped until 3 January 1947. A fungating mass was found in the right main bronchus, diagnosed microscopically grade 2 squamous cell carcinoma. Exploratory thoracotomy was done on 16 January 1947. Metastases were found in the inferior mediastinum and the diaphragm; pneumonectomy was not considered possible.

COMMENT

Urgent, decisive action may be as important in bronchogenic carcinoma as in many of the conditions more commonly considered to be emergencies.

SUMMARY

1. Reliable evidence indicates that bronchogenic carcinoma is increasing in incidence; in males, it is exceeded in frequency only by cancer of the stomach.
2. Since a clear-cut symptom complex is rarely present, one must constantly suspect carcinoma in the presence of any pulmonary symptoms or signs of doubtful etiology.
3. Once a reasonable suspicion of lung carcinoma exists, the investigator should be duty bound to pursue a vigorous investigative course, using all available facilities necessary to establish a conclusive diagnosis.
4. Advances in surgical technique and management, applicable only in the early stages of the disease, have put a new responsibility on the medical profession to diagnose the condition early enough for surgery to be effective.

REFERENCES

1. OCHSNER, A.: Bronchogenic carcinoma. *New York Med.* 2: 19-20, Mar. 5, 1946.
2. KOLETSKY, S.: Primary carcinoma of lung; clinical and pathologic study of 100 cases. *Arch. Int. Med.* 62: 636-651, Oct. 1938.
3. OVERHOLT, R. H., and RUMEL, W. R.: Clinical studies of primary carcinoma of lung; analysis of 75 cases, 21 of which were treated by pneumonectomy or lobectomy. *J. A. M. A.* 114: 735-742, Mar. 2, 1940.
4. HAUSER, H.: Cancer of lung in infancy. *Radiology* 39: 33-38, July 1942.

5. HORN, H. A.: Primary carcinoma of lung, including clinico pathologic report of 45 cases at University Hospital from 1934-46. *Bull. School Med. Univ. Maryland* **30**: 169-184, Apr. 1946.
6. GRACE, E. J.: Tobacco smoking and cancer of lung. *Am. J. Surg.* **60**: 361-364. June 1943.
7. ADAMS, R.: Primary lung tumors. *J. A. M. A.* **130**: 547-553, Mar. 2, 1946.
8. MOERSCH, H. J., and TINNEY, W. S.: Carcinoma of lung. *Minnesota Med.* **26**: 1046-1051, Dec. 1943.
9. JONES, J. C.: Surgical aspects of bronchogenic carcinoma. *J. A. M. A.* **134**: 113-117, May 10, 1947.
10. HOCHBERG, L. A., and LEDERER, M.: Early manifestations of primary carcinoma of lung. *Arch. Int. Med.* **63**: 80-99, Jan. 1939.
11. OLDS, J. W., and KIRKLIN, B. R.: Primary carcinoma of lung; roentgenologic study of 206 proved cases. *Am. J. Roentgenol.* **44**: 357-369, Sept. 1940.
12. JACKSON, C. L., and KONZELMANN, F. W.: Bronchoscopic aspects of bronchial tumors, with special reference to so-called bronchial adenoma; reports of 12 cases. *J. Thoracic Surg.* **6**: 312-329, Feb. 1937.
13. HERBUT, P. A., and CLERF, L. H.: Bronchogenic carcinoma; diagnosis by cytologic study of bronchoscopically removed secretions. *J. A. M. A.* **130**: 1006-1012, Apr. 13, 1946.
14. FARINAS, P. L.: Recent progress in bronchographic examination of bronchogenic carcinoma. *Am. J. Roentgenol.* **44**: 370-383, Sept. 1940.



APHORISMS ON PEPTIC ULCER SEEN IN THE NAVAL SERVICE *

LEWIS GUNTHER ¹
Commander (MC) U. S. N.

THE PRONOUNCED increase in the case incidence rates for diseases during World War II (1), gave medical officers the opportunity to observe large numbers of a given entity within a relatively short period of time.

Approximately 4,500 original upper gastro-intestinal x-ray series (not including recheck examinations) were done at the U. S. Naval Hospital, Long Beach, Calif., from 1 January 1944 to 5 July 1945.² (See tables 1, 2, and 3.) These aphorisms, based on observations on nearly 1,000 patients with peptic ulcer³ are drawn from material compiled for teaching purposes (2).

TABLE 1

Ulcer, duodenum (nonobstructing) with crater-----	557
Ulcer, duodenum without crater ¹ -----	384
Ulcer, duodenum and gastric in the same patient-----	2
Totals ulcer, duodenum-----	943

¹ Deformity, spasm edema of the duodenal cap with indirect signs of an active lesion.

A diagnostic and treatment routine was followed on all patients who were admitted to the gastro-intestinal service with the diagnosis of duodenal, gastric, or of suspected peptic ulcer. The diagnostic and treatment procedures (shown in the appendix) progressed simultaneously. All patients were put to bed on admission. If the diagnosis was verified, the patient remained under treatment in bed for 21 days. He was allowed toilet privileges. When peptic ulcer, or a related gastro-intestinal disease was not found, the patient was transferred to another ward.

* Read before the Regional Meeting of the American College of Physicians, Johns Hopkins Hospital, Baltimore, Maryland, April 5, 1947.

¹ Resigned 25 September 1947.

² All but 37 patients of this report were observed at the U. S. Naval Hospital, Long Beach, California. The x-ray examinations were made by Capt. Russell Gates (MC) USNR. The remainder were seen at the U. S. Naval Hospital, Camp White, Oregon, and at the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Maryland.

³ These impressions are based on personal experiences and in no manner reflect the opinion of the Navy or other members of the staff. I have drawn freely on knowledge gained in consultations and discussions with other staff members. Grateful acknowledgement is made to Capt. Walter M. Simpson (MC) USNR, Capt. E. Eric Larson (MC) USNR, and Comdr. L. Bean (MC) USN.

TABLE 2

Ulcer, gastric ¹ -----	47
Ulcer, gastric in malignancy, x-ray diagnosis-----	7
Ulcer, gastric and duodenum in same patient-----	2
<hr/>	
Total ulcer, gastric-----	56
Total duodenal ulcer-----	943
Totals, peptic ulcer-----	999

¹ Seropositive syphilis, concurrent diagnosis, 5.

TABLE 3

Ulcer, gastric in malignancy, x-ray diagnosis-----	7
Malignancy stomach, x-ray diagnosis-----	21
Malignancy stomach, histologic diagnosis after excision of ulcer, gastric-----	14
<hr/>	
Total malignancy-----	42
Total peptic ulcer-----	999
Total patients-----	1,032

The diet consisted of frequent feedings of milk and cream with additions of egg, cooked cereal, custards, jello, respectively at 3-day intervals. The milk and cream mixture was given every hour on the hour and an alkali, usually aluminum hydroxide, every hour on the half hour. The first recheck x-ray examination was done at 5 weeks.

Hemorrhaging patients were given morphine in physiological doses, intravenous fluids, plasma, and transfusions of whole citrated blood in amounts from 500 cc. to 2,000 cc. daily as indicated. Food was withheld until the bleeding stopped.

AT WHAT AGE DOES PEPTIC ULCER FIRST APPEAR?

"In the Naval Service, nonobstructive duodenal ulcer was a disease that occurred in greatest numbers in young adults."

Of the 240 gastro-intestinal beds, up to 200 were occupied at one time by patients with verified peptic ulcer. The author was impressed by the number of immature and boyish faces, including many teen-agers, and the large proportion of young men in the early twenties. He was convinced that there were even a few who were only 15 or 16 years old.

Data obtained from the Medical Statistics Division of the Bureau of Medicine and Surgery (3) showed that nearly 30 percent of the total patients with peptic ulcer during the war years of 1942-1945 were 24 years old and under; 50 percent of the total number of cases were 29 years old and under. The rate for the age of 19 years and under (the teen-agers) in 1942 was 51.97 per 100,000. This rate was 45 percent of the lowest average peacetime rate for the Navy in 1938.

In civilian practice the author has seen duodenal ulcer with crater in patients 14 years of age. Recently a patient at the National Naval Medical Center, who had a long standing history, told of having carried a crust of bread in his pocket at school when 13 years old. He munched on it in the classroom to assuage the pain that occurred each morning around 11 a. m.

"The diagnosis of duodenal ulcer must be given serious consideration in the differential diagnosis of abdominal pain as early as the beginning of adolescence."

"Recurrences and complications of duodenal ulcer with distortions of the cap were seen, in the main, in the late twenties and upward."

"Gastric ulcer occurred oftener in the older age group, but was seen also in the early twenties."

ON THE ROLE OF TENSION IN PEPTIC ULCER

The importance of nervous tensions in peptic ulcer patients is generally recognized. The role of tensions in Naval personnel under conditions of war must also have been an important one.

The combined average yearly rate per 100,000 for duodenal and gastric ulcer and perforations is shown in graph form from 1936 to 1945 (fig. 1).⁴ The incidence rate rose to a high level in 1942 and

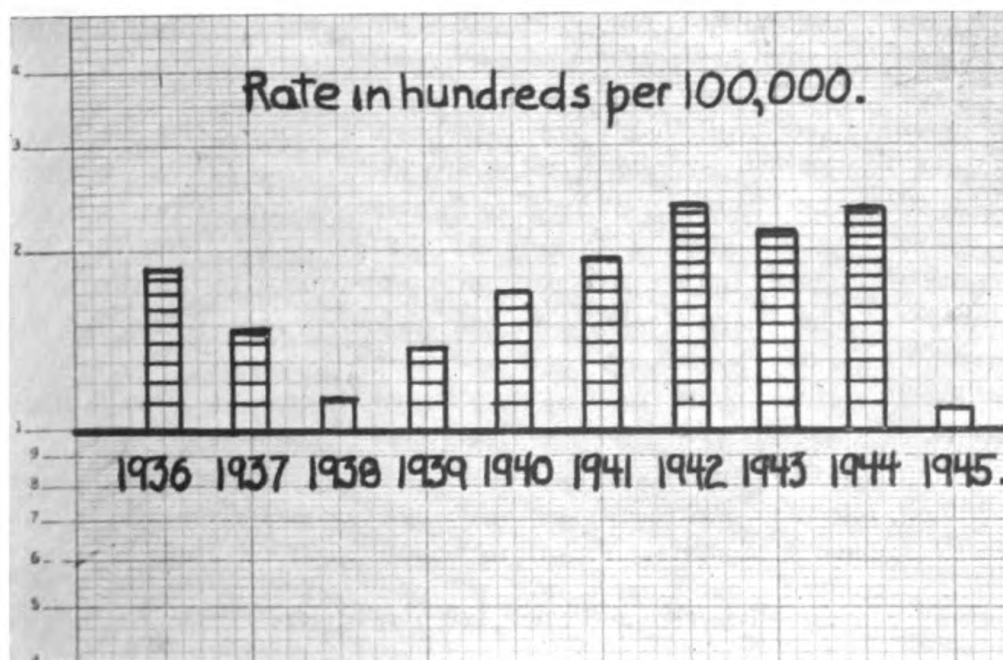


Figure 1.—Average rates. The incidence rate rose to a high level in 1942 and was maintained at the high level during the war years.

⁴ From data prepared by the Medical Statistics Division of the Bureau of Medicine and Surgery, Navy Department.

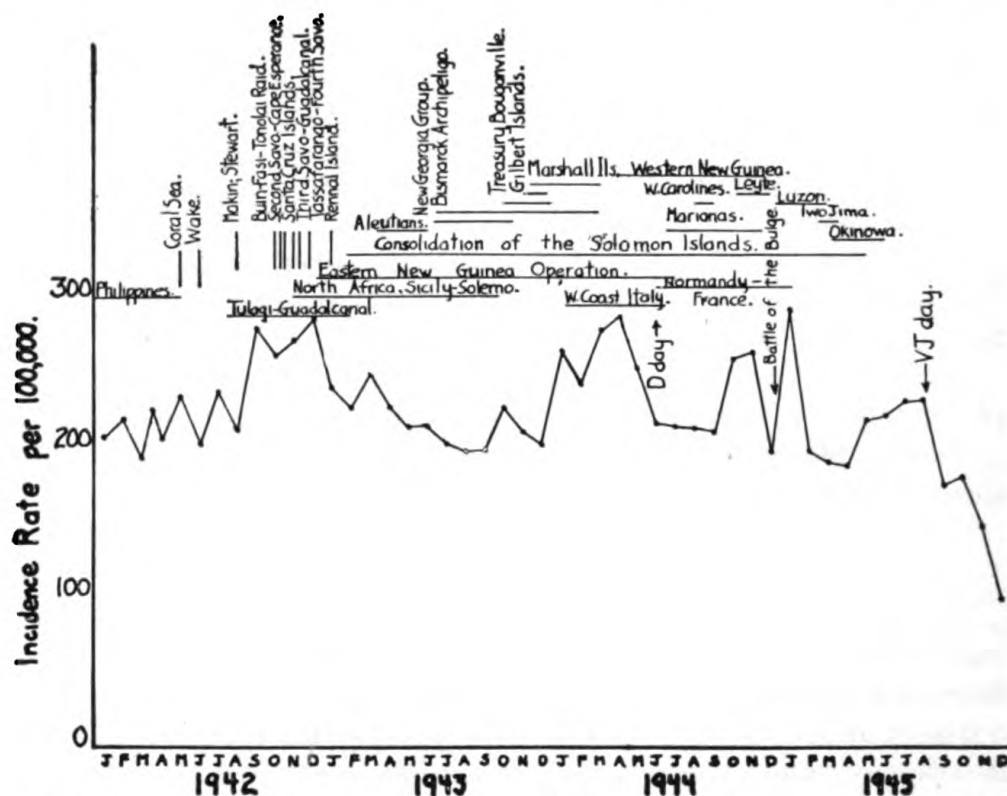


Figure 2.—Monthly rates. The peaks which occurred during the high incidence rate during the war years coincide with the tempo of the war. The highest incidence rate reached in January 1945 after the Battle of the Bulge and the marked drop after the month of VJ day are particularly striking.

was maintained until 1945, when it dropped sharply to the peacetime level. The month by month rates are shown for the years 1942, 1943, 1944, and 1945 (fig. 2).⁵ The high rate beginning with January 1942 was maintained throughout the years of fighting. The monthly peaks to higher levels roughly correspond to the tempo of the war. The sharp decrease in the incidence rate following the month of VJ day is striking.

“Remove the tension factors and the incidence of peptic ulcer drops.”

“Continue the tension and nature needs help; bed rest, the dietary regimen and the indirect psychotherapeutic measures which the medical officer contributes in his daily contacts.”

ON THE PEPTIC ULCER HABITUS

On our wards, ulcers occurred in the tall and in the short; in the narrow and in the broad-chested patients, in the fat and in the lean.

“There was no exclusive ulcer type.”

⁵ See footnote 4.

"One characteristic, however, was common to all. When first admitted their dispositions were uniformly mean ones, and remained so until toward the end of the first week of treatment."

ON SYMPTOMS, AND ON TAKING OF THE HISTORY

"The sequence of postprandial and night pain, relieved by food, alkalies and milk was the same in naval personnel as in civilian practice." Yet, there were certain differences, mainly in the usage of words, which required a "nack" in the taking of the history. The description of symptoms varied from the Negro of the deep South, whose only complaint was "Doc, ah has got the misery," this was the entire history; to the white man who had a "weakness," who did not have heartburn, but had indigestion, or a bellyache. He did not obtain relief from food, but did from the drinking of milk (milk was not food). He did not obtain relief from food but felt worse when he did not eat. He did not have symptoms after meals, but his stomach hurt him an hour or two later. He did not know if sodium bicarbonate or alkalies helped, but found relief from the milk or the taking of food. He either liked milk, or he felt worse when hungry; or he didn't like milk because it "soured" on his stomach. When the language of the enlisted man was understood, it was found that the enlisted service personnel had the same daytime postprandial symptoms in peptic ulcer, relieved by food, milk and alkalies, and night pains relieved by induced vomiting, by milk, food and the ingestion of alkalies as was encountered in civilian practice.

"The patient who has an ulcer prefers to have his stomach full."

"In functional indigestion, contrariwise, he prefers to avoid food. Everything he ate, including milk, 'upset him.' Milk either 'soured' on his stomach or he obtained no definite relief, or preferred 'not to eat.' Alkalies relieved him momentarily, or he obtained his comfort from the belch that followed the taking of sodium bicarbonate or of Alka Seltzer."

"Regardless of the manner of expression in the description of symptoms, they occurred from 1 to 3 hours after meals, or just before the next meal time."

"Pain immediately at chow, or within the first 30 minutes after the meal, was more apt to be associated with functional indigestion than with an uncomplicated duodenal ulcer."

"The enlisted man who had night pains after midnight was not apt to have an ulcer." During the war the enlisted personnel ashore had their evening meal at 4:30 p. m. The men had little opportunity to obtain food after evening chow. "The night pains usually appeared by 11:00 p. m. and by midnight at the latest."

In private practice, on the other hand, patients ate as late as 9:00 p. m. and night pains occurred after midnight and before 3:00 a. m.

"Early morning pain at 5:00 a. m. or just before the morning meal, relieved by the eating of breakfast, was most often a symptom in patients who did not have a peptic ulcer."

"Epigastric distress that appeared mainly after the evening meal occurred most often in the older patient, particularly the veteran of World War I, as a symptom of coronary insufficiency."

THE SITE OF SUBJECTIVE PAIN IN PEPTIC ULCER

The most common site of subjective pain, as well as of objective tenderness, was in the epigastrium and in the right upper quadrant (fig. 3A). However, atypical locations, as low as the level of the umbilicus on the right, were not uncommon in duodenal ulcer.

"The pain of a posterior penetrating duodenal ulcer goes straight through to the back. It may even occupy an indefinitely defined area

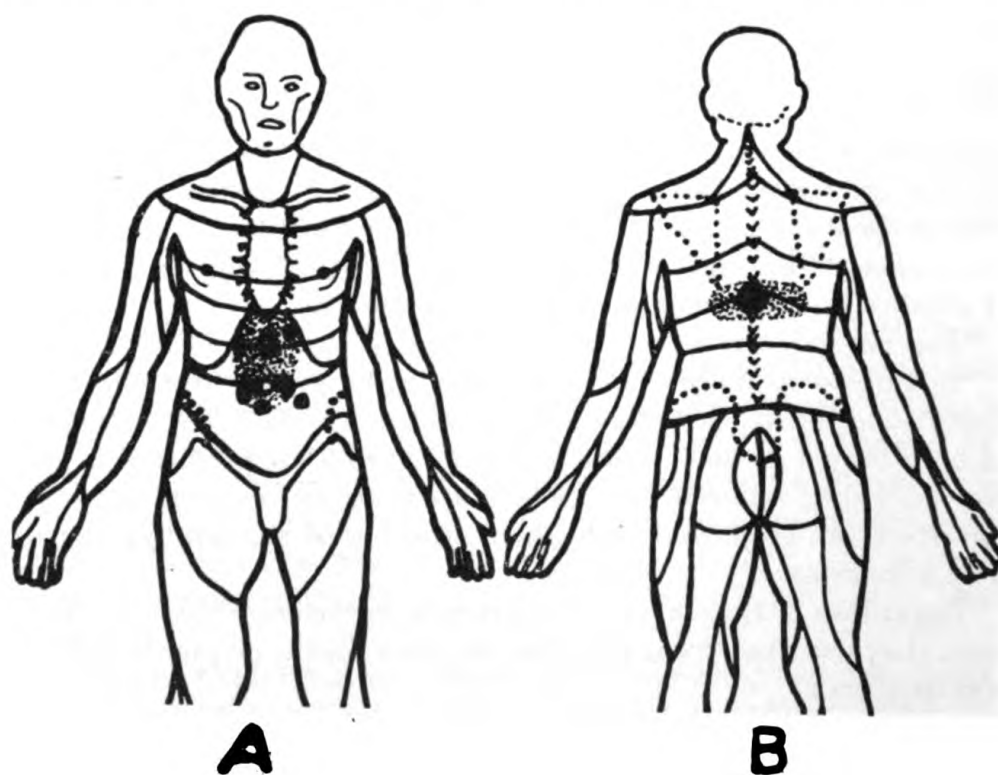


Figure 3.—The site of subjective pain and of objective tenderness in peptic ulcer (A) and in posterior penetration of duodenal ulcer (B) of patients shown in tables 1, 2, and 3. The pain of duodenal ulcer may be to the right of the umbilicus and slightly below it, but has not been encountered as low as *McBurney's point*. Gastrojejunal ulcer pain may be in the left side of the epigastrium, is most frequently encountered to the left at the level of the umbilicus, but also has been encountered in the left lower quadrant.

across the back at this level, just at or below the level of the shoulder blades." (See fig. 3B.)

"If the location of the pain was high in the epigastrium, near the left costal margin, a gastric ulcer was suspected."

"I know of no way in which to differentiate a duodenal from a gastric ulcer from the history, the location of the pain, or the physical examination."

"Even in the acute abdominal crises seen in gastric ulcer, and also occasionally in duodenal ulcer, which so strongly simulates an acute gallbladder colic, one could not be certain of the site of the ulcer until the x-ray report was in."

"Gastrojejunal ulcer pain was found at the level of the umbilicus and to the left of it. It was also encountered in the left lower quadrant." (See fig. 3A.)

"The leading symptom in our patients with peptic ulcers was pain, heartburn, or some other variety of words describing these sensations. Vomiting occurred in about half of the patients but was never a prominent symptom, except in the obvious obstructive lesion."

"The words 'heartburn,' 'pain,' 'soreness,' and 'indigestion,' and 'burning' were most often used." "As helpful as the patient's language and usage of words in describing pain were the motions of his hands which accompanied his verbal description. There is a language in the hands, useful in diagnosis."

THE LANGUAGE OF THE HANDS

As the patient describes his symptoms, *watch his hands*. In peptic ulcer, he indicates the painful site in the epigastrium by placing the hand open palm downward on the abdomen (fig. 4A). He not only has subjective pain, which he demonstrates with the finger tips, but he also means that there is a sore spot when he presses in with the tip of a finger (fig. 4B).

Patients with diseases other than peptic ulcer use both hands or fists (fig. 5) to describe their pain. "A clenched fist held over the epigastrium does not indicate an ulcer. This is especially true if the patient uses such words as 'pressure,' 'squeezing,' 'weight,' or 'crushing.' He is describing the constrictive sensation encountered in myocardial infarction."

"Both fists clenched and pushed into the pit of the abdomen, have the same significance." "If he places the heels of both palms on the sides of the chest and presses them in toward the epigastrium, or places both hands over the epigastrium the tips of the fingers meeting in the midline, he doesn't have an ulcer. Suspect heart pain." (See fig. 6A.)

"If the hands then move apart laterally, it is certainly heart pain." (See fig. 6B.) He is also describing the constrictive pain of coronary insufficiency.

*Figure 4a**Figure 4b**Figure 5*

Figure 4.—The patient with ulcer indicates the site of his pain with the hand, palm downward, using the tips of the fingers (A) or points to the spot with one finger (B).

Figure 5.—The clenched fist held over the epigastrium is used to indicate the constriction of cardiac pain. Look for coronary occlusion.

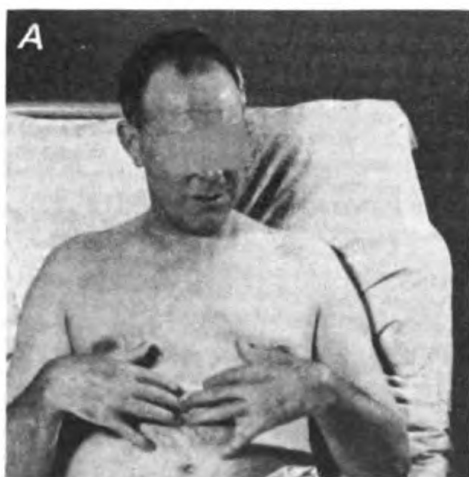
*Figure 6a**Figure 6b*

Figure 6.—(A) Both hands placed over the epigastrium with the tips of the fingers meeting in the midline, suspect heart pain. (B) If the hands move apart laterally, it is heart pain.



Figure 7

Figure 7.—The site of the gastro-intestinal pain (reno-gastric reflex) which proceeds or accompanies the renal ureteral pain.



Figure 8

Figure 8.—The site of the renal-ureteral pain (may also be at the costal angle).

Figure 9.—The radiation of the renal-ureteral pain.



Figure 9

Epigastric pain may be prominent, described as cramps, pain, or even heartburn in renal-ureteral disease (fig. 7). The patient may place the flat of the hands and the fingers on the epigastrium as does the patient with ulcer, but he soon shifts the hand to the costal angle, or to the crest of the ileum posteriorly (fig. 8). In this latter location, he will talk of soreness, or of a cramping sensation that comes and goes. He may even indicate the radiation toward the genitalia as did this patient (fig. 9). These hand movements in renogastric reflexes are helpful in interpretation of the rumbling and grumbling in the intestinal tract, and of the heartburn and initial epigastric symptoms that accompany or precede the renal pain and which so closely simulates peptic ulcer pain.

It was common to find patients of the older age group on the gastro-intestinal ward with the diagnosis of ulcer, who suffered from root

pain associated with arthritis of the spine, or with metastatic lesions in the spine. The patient's fixation on his epigastric symptoms is misleading. When he is questioned (and he must be questioned), he will reveal the remainder of the painful area and the root radiation into the side of the chest and to the back. The false association of disagreeable sensations with food may be so fixed that he has become a food faddist or has remained on a milk diet for a long time, with variable results.

He describes his pain and indicates its location and radiation with the widespread index finger and thumb, or with two widespread fingers (fig. 10A), which trace a band or zone of pain across the epigastrium (fig. 10B). He uses words such as aching, dull ache, or paraesthetic sensations such as numbness, tingling and prickling.

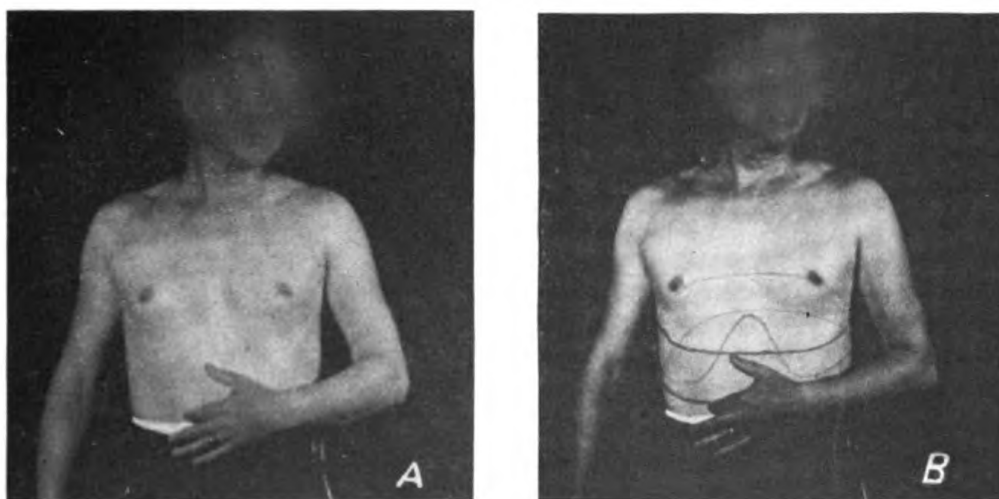


Figure 10.—Demonstrating the manner of describing root pain. The widespread index finger and the thumb (sometimes two fingers, widely spread), indicating a zone of pain over the epigastrium. Because of the patient's fixation of symptoms on the epigastrium, he must be questioned: "Where does the pain go from there?" The hand then moves across the epigastrium, around the side of the chest and into the back; the level rises as it progresses posteriorly, to reach under the angle of the scapula. This is root pain (radicular pain). Do not look for disease in a viscus. The anatomical lesion is in the vertebrae or in the spinal cord.

EVALUATION OF SYMPTOMS WHILE UNDER THE DIETARY REGIMEN

"Ulcer symptoms disappear rapidly under treatment."

"Ulcer patients, when first admitted to treatment, uniformly have bad dispositions. Within the first week, under the dietary regimen, they become pleasant and are easily handled."

"The disappearance of symptoms during treatment of a peptic ulcer is not an indication of healing."

"The relief of symptoms occurs so rapidly under the dietary regimen that a false sense of security develops in both the patient and in the

doctor.” “The crater of a duodenal ulcer is still present, just as it was at the beginning of treatment a week earlier.”

“A frank hemorrhage of a large amount may occur on the ward without warning, while the patient is under treatment.”

“The only measurable criteria of healing is the x-ray demonstration of the disappearance of the crater in either a gastric or a duodenal ulcer, and when possible, gastroscopic examination in a gastric ulcer.”

NIGHT PAINS

“If night pains occurred during treatment, the patient was awakened the next night an hour before symptoms were anticipated for an additional milk and aluminum hydroxide feeding. It was sometimes necessary to awaken a given individual several times during the night for additional feedings.”

The pain of posterior penetrating duodenal ulcer was encountered twice which did not respond to this regimen of interruption of sleep and additional night feedings. The continuous drip of aluminum hydroxide through a nasal tube for 2 to 3 days and nights was effective. Frequent night feedings were then resumed and the patients followed the usual course to become asymptomatic.

“Most night pains can be controlled by additional feedings of milk and aluminum hydroxide and by the use of atropine.”

“Do not use morphine to control night pains in patients who are not hemorrhaging. Its use is unnecessary and may make the patient feel worse.”

“Contrariwise, in patients who are hemorrhaging, morphine is the drug of choice.”

HYPERCHLORHYDRIA AND HYPOCHLORHYDRIA

“In patients who have high acid with demonstrable ulcer, the titratable acidity decreases with healing.”

“The patient with hyperchlorhydria, on the other hand, in whom no ulcer can be shown either initially or on the fifth week recheck, still shows high values for titratable acid after 5 weeks of therapy.”

“Hyperchlorhydria without ulcer does not respond well, or in any constant manner, to the dietary management.” “The response may be temporary and good, or symptoms continue uninfluenced by treatment.”

“The dictum no acid, no ulcer, did not conform to our experience.” “Duodenal ulcer does occur in patients who have no free acid.” “Ulcer with crater has been demonstrated in patients who had no free acid 1 hour after the use of histamine.”

The latter circumstance was found in some of the patients of the older age group over age 45.

"Although the age group over 45 is smallest in numbers, theirs is the highest incidence rate for peptic ulcer in the Naval Service."

"The patient with duodenal ulcer who had either a low or no free acid responded to the dietary regimen in the same manner as the patient with hyperchlorhydria. He obtained prompt relief of symptoms. Healing occurred."

SEROPOSITIVE SYPHILIS AND GASTRIC ULCER

Positive serological reactions concurrent with gastric ulcer occurred five times in 56 patients.

"Healing of the gastric ulcer occurred in the usual 2 to 3-week period on the dietary regimen without use of antiluetic therapy."

PERFORATION OF PEPTIC ULCER WHILE UNDER TREATMENT

"The ulcer under adequate medical management *does not perforate*."

"Contrariwise, a carcinoma of the stomach with ulcer will penetrate while under treatment."

On three occasions, concurrently and independently, patients who had proven duodenal ulcer with crater developed an acute surgical abdomen while under treatment for the ulcer. In each instance the diagnosis was acute appendicitis rather than rupture of the ulcer. Operation verified the clinical impression. These patients were under adequate medical management for the ulcer when the acute surgical symptoms first made their appearance.

ON HEMORRHAGE

"Occult blood can be demonstrated in many patients with peptic ulcer. However, frank hemorrhage of any sizeable amount occurred in only 1 out of 20 patients."

"When the sky becomes overcast or there is a sudden change in the weather, expect several admissions for massive gastro-intestinal hemorrhage. As many as 5 severe hemorrhaging patients have been admitted within the 2 days following a sudden storm."

"The rapid loss of a pint of blood will cause symptoms. There may be little in the red blood count or the hemoglobin determination to reflect this blood loss."

"Red blood cell counts vary over a large range. A variation of a million may occur when the counting is done by many different technicians as a routine procedure."

"The hematocrit, on the other hand, seems to have the least amount of variation from human error. A hemorrhage of as little as 500 cc. can easily be detected."

"When repeated each 24 hours, the volume of packed red blood cells furnishes a measurable index of active bleeding by the percentage de-

crease from the normal. The increase from a low level after hemorrhage indicates cessation of bleeding."

"When the hematocrit value stabilizes and starts rising, it can be assumed that bleeding has stopped."

"The condition of the patient, plus the reduction in the volume of packed red blood cells, aids in determining the size of the initial transfusion."

"Give approximately 100 cc. of whole blood for each point that the hematocrit is reduced below 45 percent, in multiples of 500 cc. For example, if the hematocrit is reduced to 35, the initial transfusion should be 1,000 cc. of whole blood."

"Continue daily transfusions until the hematocrit value stabilizes and discontinue when the value of 40 percent has been reached."

"Shock attending the hemorrhage is treated by the immediate infusion of fluids and plasma intravenously, while awaiting the drawing of blood for transfusion. Three to five cc. of nikethamide are given intravenously as the plasma starts to flow." "Use transfusions of whole citrated blood freely, in amounts from 500 to 2,000 cc. daily."

Of 51 severe gastro-intestinal hemorrhages, 5 failed to stop bleeding under medical management before, or by the 5th day. These were surgically explored.

Three were large posterior duodenal ulcers that were oozing freely, but were not spurting.

In two patients, the ulcer had penetrated into the pancreaticoduodenal artery and showed arterial bleeding.

"The incidence of frank arterial bleeding requiring surgical intervention in these series is approximately 4 percent."

Two patients died of hemorrhage. One had cirrhosis of the liver with hemorrhage from esophageal varices. The other patient did not show an eroded or open artery at post-mortem examination. He had two ulcers in the cardia of the stomach.

The latter patient was treated according to the theory that giving blood transfusions increased the arterial pressure and thereby blew out the clot and protracted the bleeding; as though the arterial system was a closed and rigid hydraulic system of steel pipes. Such a concept is physiologically unsound.

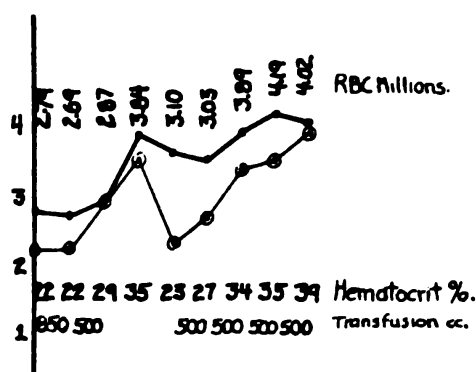


Figure 11.—Simultaneous packed cell volume (hematocrit) and red blood cell counts during hemorrhage and transfusion. The hematocrit values give a truer visual picture of the degree of bleeding and of recovery than do the routine red blood cell counts.

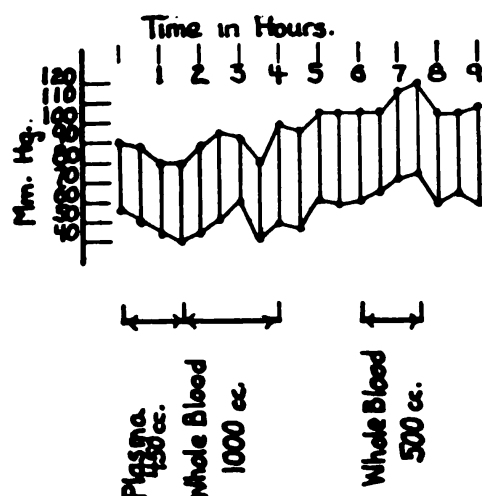


Figure 12.—Arterial pressure readings during severe hemorrhage (1,500 cc.) and blood transfusion. Upper line systolic pressures, lower line diastolic pressures in mm. mercury. The transfusion of a liter of whole blood is not followed by an immediate rise in arterial pressure. The return to normal does not occur for from 6 to 7 hours after the transfusions have been given.

compensate for hemorrhage does not immediately raise arterial pressure; it is not only a safe procedure in patients who are bleeding, but a physiologically sound one."

ON HEMORRHAGE AND PAIN IN DUODENAL ULCER

"It is generally true that the patient who begins to hemorrhage loses his pain."

"This is not always so in the patient whose ulcer is penetrating posteriorly." "He may have considerable pain while active hemorrhage is taking place."

"If a patient has a severe gastro-intestinal hemorrhage, and also pain, particularly if it radiates straight through to the back, suspect erosion into a fair-sized artery and arterial bleeding."

"If the bleeding does not stop within 3 days he is a candidate for surgical consultation."

X-RAY EXAMINATION IN THE PATIENT WHO HAS HEMORRHAGED

"Exposure to x-ray, even that used in the fluoroscopy and radiation needed for a gastro-intestinal series may begin a hemorrhage or perforation or increase mild bleeding, irrespective of the mechanical manipulation of the examination which alone is a considerable hazard in such a situation."

"The most massive gastro-intestinal hemorrhage in my personal experience was seen in a patient with hypertrophic gastritis without demonstrable ulcer, due to widespread surface oozing rather than from arterial bleeding."

Figure 12 shows the effect of blood transfusion in a patient in shock whose blood loss was estimated to be 1,500 cc.

"The transfusion of whole blood did not raise arterial pressure immediately (figure 12). The patient's normal pressure of 120/70 was not reached for 7 hours after the beginning of the transfusion of plasma and of whole blood."

"The transfusion of whole blood in adequate amounts to

“Do not subject patients who have hemorrhaged to a gastrointestinal x-ray examination until 3 weeks after the bleeding has stopped.”

“The ulcer crater can be demonstrated under these circumstances in only about 50 percent of the patients after hemorrhage.”

HEALING IN PEPTIC ULCER

“Untreated, and in this category I would place the usual office type of ambulatory treatment, about a third of duodenal ulcers will probably heal spontaneously within a period of 2 months.”

“In this series, healing occurred at the rate of about 30 percent each month. About one-third showed complete healing when rechecked at the end of 5 weeks. About 30 percent more, a total of about 60 percent, showed complete healing at the end of 2 months, and nearly 90 percent were healed in 3 months. About half the remainder required from 5 months upward for complete healing.”

“There is a small percentage, probably 5 percent in whom the roentgenologist can never demonstrate complete healing.”

“Smoking during treatment tends to prolong the period before complete healing can be demonstrated.”

“Some patients heal in spite of cigarettes.”

“Gastric ulcers uncomplicated by malignancy, heal within 2 to 3 weeks on the dietary regimen.” (Untreated, from 4 to 8 weeks.)

“A recheck examination performed routinely in 2 weeks shows about a three-fourths reduction in the size of the crater.”

“If a gastric ulcer does not show approximately a 50 percent reduction in the size of the crater by x-ray examination after 2 weeks of bed rest and dietary management, it is probably a malignancy, and surgical removal is indicated.”

A high percentage of gastric ulcers which did not show appreciable healing after the 2-week period of medical management were demonstrated to be malignancies on histological examination (14 out of 15 in this series) (4).

DESOXYCORTICOSTERONE ACETATE

A deviation from the prescribed routine was made recently in 28 patients. Desoxycorticosterone acetate was used in addition to the basic routine. Ten milligrams of percorten was given by intramuscular injection every other day for 5 weeks. No sodium retention or untoward symptoms were observed.

“Of this small series, about 60 percent showed complete healing on the first recheck x-ray examination at 5 weeks.” Those that were not completely healed showed a minute fleck at the site of the crater. This was in contrast to the measurable crater still present in unhealed patients under the routine management without the use of desoxycorticosterone acetate.

"About 90 percent of the patients under treatment with desoxycorticosterone acetate showed complete healing by the second month recheck."

"The addition of desoxycorticosterone acetate to the medical management of duodenal ulcer seems to speed the healing time."

ON HYPERTROPHIC GASTRODUODENITIS

"Gastro-intestinal symptoms are common in patients who have had repeated attacks of malaria."

"Suspect hypertrophic gastritis, rather than peptic ulcer in patients with ulcer symptoms who have had frequent recurrences of malaria, but do not be surprised occasionally to find both."

"Hypertrophic gastritis and duodenitis and hyperchlorhydria without demonstrable ulcer simulates the ulcer syndrome perfectly." "The final diagnosis must be based on the compilation of all available data from x-ray examination, gastric analysis and gastroscopy."

REFERENCES

1. BUREAU OF MEDICINE AND SURGERY, UNITED STATES NAVY DEPARTMENT: Medical Statistics, Report of the Surgeon General, United States Navy. Navmed 154. Annual Report of the Surgeon General, United States Navy, Chief of the Bureau of Medicine and Surgery, to the Secretary of the Navy Concerning Statistics of Diseases and Injuries in the United States Navy for the Calendar Year 1943. Government Printing Office, Washington, D. C., 1947.
2. GUNTHER, L.: Guide for internes on the gastro-intestinal service, U. S. Naval Hospital, Long Beach, Calif. (Unpublished.)
3. WARE, R. L., Capt. (MC) USN. Chief of Medical Statistics Division, Bureau of Medicine and Surgery, Navy Department.
4. LARSON, E. E., Capt. (MC) USNR, former Chief of Surgery, U. S. Naval Hospital, Long Beach, Calif.

THE MANAGEMENT OF PEPTIC ULCER

A. On patients without gross hemorrhage.

1. Diagnostic procedures.

- a. History and physical examination to include a rectal examination and a proctoscopic examination on the ward.
- b. Omit gastric analysis and gastro-intestinal series on patients who are hemorrhaging.
- c. Gastro-intestinal x-ray series to be ordered immediately on admission.
- d. Gastric analysis, to be ordered immediately.
- e. Three stools to be examined for ova and parasites and for occult blood. Begin on third day after admission.
- f. Red blood count, white blood count, differential, hemoglobin and packed red blood count volume (hematocrit) on admission.
- g. Urine analysis.
- h. Gallbladder dye series when indicated.
- i. Obtain date for recheck gastro-intestinal series for the fifth week on patients with duodenal ulcer.

- j. Obtain date for recheck gastro-intestinal series for the end of the second week on patients with gastric ulcer.
2. Treatment.
- a. Bed rest for 21 days. Head privileges only. Progressive dietary regimen as described under No. 4.
 - b. Begin the dietary regimen immediately on admission.
 - c. If the diagnosis of peptic ulcer or one of its related conditions, such as hypertrophic gastritis, diverticulum, malignancy, etc., is not verified, transfer to the proper service.
 - d. The milk and cream mixture is to be given every hour on the hour.
 - e. The alkali every hour on the half hour.
 - f. The gastric sedative 3 to 4 times daily, as ordered by the ward medical officer.
 - g. Constipation and fecal impactions are a common sequela of the alkali used. Be watchful for its symptoms. Mineral oil, 15.0 cc. to be given each morning, and the cascara mineral oil mixture, 15.00 cc. each evening.
 - h. Percorten (desoxycorticosterone acetate—D. C. A.) 10 mg. every other day, or 5 mg. every day intramuscularly until the first recheck x-ray of 5 weeks. On order of the ward medical officer only.
3. Alkalies.
- a. Amphojel or cremalin (aluminum hydroxide preparations) (drams 1 (4.0 cc.) diluted in half a glass of water.
 - b. Sippy powder number 1 (laxative) or Sippy powder number 2, 1 level teaspoonful, only on order of ward medical officer.
 - c. Milk of magnesia may be used occasionally to combat constipation, on order of ward medical officer.
4. The progressive milk-cream dietary regimen.¹
- First and second days: 1½ ounces milk and cream, equal parts, every hour on the hour from 0600 to 1830, and every half hour from 1830 to 2130 during the first 3 weeks. Whole milk, or whole milk boiled may be substituted on order of ward medical officer.
- Third and fourth days: Add one soft-cooked egg at 0700.
- Fifth and sixth days: One soft-cooked egg at 0700. Cooked cereal 3 ounces at 1200.
- Seventh and eighth days: One soft-cooked egg at 0700. Cooked cereal 3 ounces at 1200. Jello, 3 ounces at 1700.
- Ninth and tenth days: Cooked cereal 3 ounces at 0700. One soft-cooked egg at 1200. Jello 3 ounces at 1500. Custard 3 ounces at 1700.
- Eleventh to twenty-first days: Cooked cereal 3 ounces at 0700. Jello 3 ounces at 1000. One soft-cooked egg at 1200. Custard 3 ounces at 1500. One soft-cooked egg at 1700.
- Twenty-first day: Patient may be up and out of bed around the ward.
- Twenty-second to twenty-eighth days: Five feedings as above. Continue milk and cream every hour on the hour. Continue alkali every hour on the half hour, the last dose at 2100. The half hourly feedings of alkali after 1830 can be omitted.
- Fifth week: Bland, meat-free diet, 3 meals daily on the ward. Milk, one glass at 1000, 1500 and 1700. Alkali every hour on the hour between meals until 2100. Recheck gastro-intestinal series on duodenal ulcer patients.

¹ Modified from the outline devised by Capt. A. G. Bowers, (MC) USNR.

5. Sixth week until discharged.

a. Bland diet with broiled or roasted meat at noon in mess hall, unless modified by order of the ward medical officer. (Patients who have not shown complete healing at the fifth week recheck, will remain on the bland meat-free diet.) All vegetables are puréed. Continue mid-meal feedings and alkali every hour. Citrus fruits not allowed.

6. Smoking is not allowed.

7. Coffee is not allowed.

8. After the fifth week, the gastro-intestinal series is to be rechecked every month until healing is obtained.

9. Recheck the gastric analysis in the fifth week and again when x-ray evidence of healing has been reported.

10. Night pains:

If at morning sick call, the patient complains of distress at a specific hour after the lights are out, order additional feeding of milk and alkali, 1 hour before the anticipated symptoms. It may be necessary to awaken a given patient several times each night for such feedings.

Unless the patient is hemorrhaging. *Do not order morphine for night pains.* An additional dose of the gastric sedative plus the milk and alkali will suffice in most instances. Atropine sulfate 1/100 grain (0.0006) by mouth or by hypo may be used with success.

B. On patients with gastro-intestinal hemorrhage.

1. Diagnostic procedures.

a. Red blood count, white blood count, hemoglobin, differential and packed red cells volume (hematocrit), on admission as an "emergency."

b. Blood type, Rh factor, and cross match for immediate transfusion of blood, at least 500 cc. initial. Additional amounts of blood or of washed red blood cells, as ordered by the ward medical officer.

c. Recheck the hematocrit every morning at 0700, to have the report available in time for the morning sick call.

d. Nonprotein nitrogen immediately on admission as an "emergency."

e. Recheck the nonprotein nitrogen each morning if bleeding continues.

f. Urine analysis immediately on admission for specific gravity, albumin, sugar, acetone; chemical for hemoglobin; sediment for red blood cells, white blood cells, casts.

g. Daily urinalysis as above until discontinued by order.

2. Treatment.

a. Absolute bed rest.

b. Morphine sulfate grains $\frac{1}{4}$ (0.015) every 4 hours for 6 doses, until physiologically tolerated. Respirations may drop to 12; discontinue morphine if respirations go to 12. If you have overshoot the physiologic dosage and Cheyne-Stokes appear, give 4 grains caffeine-sodiobenzoate every 3 hours. The respirations will become regular. Do not give too often or the patient will become very restless. Repeat the order for morphine with stop at 6 doses each day as above.

Hemorrhaging patients stand large amounts of morphine.

c. Nothing by mouth except cracked ice until the patient stops bleeding.

d. Ice bag to abdomen.

e. Immediately after admission to the ward, while awaiting the blood reports and blood for transfusion, begin an intravenous infusion of saline. Keep the fluid going until the blood is available.

- f.* If the patient presents signs of shock, begin an infusion of plasma in the other arm. He will usually take 500 cc. before the blood is available. If the shock is severe, clamp off the tubing and inject 3 to 5 cc. of coramine (nikethamides) directly into the tubing on the vein side, open the clamp and permit the plasma to flow.
- g.* Use the value of 45 hematocrit as the average normal. Order blood for transfusion in multiples of 500 cc. (100 cc. for each percent decrease in the hematocrit). For example: If the hematocrit value is 35, order 1000 cc. of whole blood or its equivalent in *washed red cells*, for the initial transfusion. If the hematocrit is down to 30, order 1,500 cc. of whole blood for the initial transfusion.
- h.* The clinical condition of the patient, the presence or absence and recovery from shock must be the guide for additional amounts of blood during each 24 hours. A recheck on the hematocrit within the first 12 hours after transfusion when aid as a rough guide as to the net gain and the rate of bleeding. For example, if all bleeding had stopped, you gave a 1,000 cc. whole blood transfusion when the hematocrit was at 30 percent, you cannot expect over 5 points increased in the hematocrit even if all the transfused blood is retained. Be satisfied if the next hematocrit is at the same level. This at least indicates that you have kept pace with the rate of bleeding.
- i.* When the hemorrhage ceases, the hematocrit will begin to rise.
- j.* Continue the daily transfusions until the hematocrit reaches 40 percent.
- k.* Between the second and fourth day, usually about the third day, a patient receiving multiple transfusions of whole blood, is apt to have a chill and a rise in temperature during a transfusion. This usually occurs late, after most of the transfusion has run in. This may or may not be true transfusion reaction. Stop the particular bottle of blood. Give the patient an enema. The result will be a foul and putrid stool of decomposed blood. Check all urines for 6 hours. If dark urine appears, test for hemoglobin and notify the chief of medicine that the patient has had a delayed transfusion reaction. If the urine remains negative for hemoglobin, proceed with the next 500 cc. bottle if the patient still needs blood.
- l.* *A reaction that appears within a few minutes after the transfusion has begun to flow is a danger signal.* Look for dark urine containing hemoglobin. This is a true transfusion reaction, and signifies a possible renal shutdown. *Stop immediately*—notify the chief of medicine and give no further blood or saline until specifically approved by the chief of medicine. When the first urine appears, watch the blood chloride level. Saline in large amounts is imperative.
- m.* Each morning and evening, administer 1,000 cc. of 10 percent dextrose in distilled water and saline respectively. This is in addition to the initial fluids given on admission and any blood that has been given. The basal caloric needs are covered by these infusions.
- n.* When the hematocrit begins to increase, start the dietary regimen. Omit the gastric sedative for 1 week.
- o.* In the third week after bleeding has ceased, order gastro-intestinal series, x-ray examination, and gastric analysis.

THE USE OF PLASMA IN THE TREATMENT OF COMBAT FATIGUE

PHILIP SOLOMON
Commander (MC) U. S. N. R.

EVERY medical officer who has served overseas in World War II knows the incidence and importance of combat fatigue. Various articles have appeared on the subject, but since the present paper is being written in the field, no attempt will be made to review the literature. There has been general agreement that combat fatigue is an acute psychoneurotic reaction occurring in relatively normal individuals under the stress of actual combat conditions. It is recognized that among the precipitating factors, physical exhaustion, lack of proper ingestion of food, insufficient rest and sleep, and exposure to the elements play a role. It would seem reasonable that these factors reduce the individual's ability to withstand the emotional strains of combat.

In a Marine division in combat an attempt has been made to remedy as quickly as possible the physical factors of depletion in patients with combat fatigue by giving a unit of blood plasma to each patient as soon as he arrived at the field hospital. Since the field hospital moved constantly to keep directly behind the front lines, patients were often seen within an hour or two of their break-down.

A clinical description of the cases, the military circumstances under which they occurred, the set-up of the neuropsychiatric ward, and the general details of treatment and results will not be given here, because the present operation is still in progress and time is not available. It may be said briefly that this study has been made by the division psychiatrist in a combat operation against an organized Japanese foe on an island in the Orient. Most of the cases in the study occurred in the first month of the campaign, but some occurred in the second month, and a few in the current third month. The clinical severity of the cases did not seem to differ materially at the various times, and they were all quite comparable to those described in the literature.

RESULTS

The immediate result of plasma was uniformly good in every case. Patients spontaneously said they felt stronger and more relaxed. Ob-

jectively, the effect was sometimes dramatic. Restlessness, obvious tension and startle reaction decreased, and in some instances, patients promptly went to sleep without sedation. A few patients said their appetite was stimulated and they ate with relish for the first time in many days. These observations and opinions were corroborated, often with enthusiasm, by several medical officers and corpsmen who assisted in the treatment. In many instances other medical officers have proceeded to use the plasma treatment on their own in the various battalion and regimental aid stations.

In the first 24 cases in which plasma was given, all patients returned to full duty. Two were returned in 1 day, 6 in 2 days, 13 in 3 days, 1 in 4 days, and 2 in 5 days. These results seemed so spectacular that we were frankly skeptical. Other elements in the treatment—rest, hot food, mild sedation, the atmosphere of the ward (for which the specially trained corpsmen, chaplains, and Red Cross men were largely responsible), the individual psychotherapy, and occasional group therapy—might well have been the entire answer. We therefore began a control study, alternating cases with and without plasma, only the corpsmen knowing which cases were which. After 16 cases, all had returned to duty, with an average of 3 days on the ward in each series!

DISCUSSION

In spite of the small group of cases, it was obvious that plasma neither increased the number of patients who could be returned to duty, nor decreased the stay on the ward. The qualitative effect, nevertheless, seemed so good that we were all reluctant to give it up. It seemed that the recovery curve, though it reached the point of return to duty at the same time, was made steeply convex upward with plasma instead of convex downward without plasma. Unquestionably much of the effect was probably psychological. Patients were impressed that they were getting the plasma they had heard such wonderful things about. They also seemed grateful to be treated like organic cases instead of like "psycho" cases. Perhaps their attitude contributed to the generally optimistic spirit of the ward.

An abrupt change in the military character of the campaign brought about a sudden great influx of patients with combat fatigue. The plasma program, perforce, had to be given up, at least as a routine, because there was no room to keep all the patients, and insufficient time or personnel to conduct treatment as we would wish. Since this change, plasma has been used only in those patients who seemed unusually depleted physically, and then only if time permitted. No further attempt at scientific appraisal has been made, though it is recognized that a controlled study when the recovery rate is less than 100 percent would be of interest. About all that can be said is that

plasma has been given in some 30 or 40 additional cases of combat fatigue, for the most part in aid stations at the front, and that reports from the medical officers continue to be good. The most interesting feature, from the standpoint of the author, is that these medical officers, having heard about the treatment incidentally, have tried it out on their own and have spontaneously adopted it in a natural way as part of their routine clinical armamentarium.

CONCLUSIONS

It is felt that this study has failed to demonstrate any scientific substantiation for the value of plasma in the treatment of combat fatigue. Clinical impressions indicate that plasma may serve as a useful adjunct to other forms of treatment.

ACKNOWLEDGMENT.—The author wishes to acknowledge the valuable assistance of Lt. Harold Lehrman (MC) USNR in this work.



INTERESTING NOTES ON BIPARTITE PATELLAE

JOHN J. CALLAHAN
Lieutenant (MC) U. S. N. R.

THE stimulus for collecting this small series of cases, concerning a relatively obscure condition, has been prompted by a number of factors. In 8 months, six cases have been seen on the orthopedic service of a hospital. They all have had admission diagnoses of fracture, simple, patella. All had been seen at various medical facilities by numerous medical officers, and had averaged 15 days on the sick list prior to admission; the highest number of sick days for any one patient was 70. In this series, every patient admitted had suffered some recent service-connected injury to a knee and, after radiographs had been obtained, the pathology was diagnosed as fracture and subsequently treated and admitted to the hospital.

The historical background of these congenital anomalies is interesting. Kempson (2) in 1902, discovered the condition on an Egyptian mummy. Later, the same year, Joachimstal produced the first positive radiological evidence of the bipartite character of the bone. The first large complete series was reported by Salmond (3) during the late years of World War I. No attempt has ever been made to establish a percentage basis of the anomaly to the normal. However, the rare occurrence of the condition is shown by the four series to which the author refers. Adams and Leonard (6) collected 6 in 5 years; Tabb, Faulkner, and Smith (1) published 5 in 1 year. Smith (7), in his scholarly article, does not tell how much time was required for his series of 26.

The cause for this condition appears to be anything but clear. Leviasser (5) states that it is due to a failure of fusion when the bone arises from two or more centers of ossification. Hawley and Griswold (4) associate the condition with osteochondritis. Smith (7) believes it to be a persistence of separate ossification centers. Salmond (3), after a careful review of all concepts of causes, believes a bipartite patella is due to the tension produced by an over-stretched capsule in a lateral direction or by an unequal pull of the vasti muscles. Cunningham (8) described the bone as a sesamoid, develop-

ing from one or more centers in the patellar tendon. The bone makes its appearance during the third year and is completely fused at puberty. One fact is clear however, that childhood trauma cannot be classed as an etiological agent.

There are six generally recognized types of anomalous patellae.

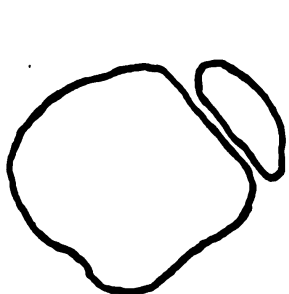


Figure 1.—The smaller fragment is always in the upper and outer quadrant.

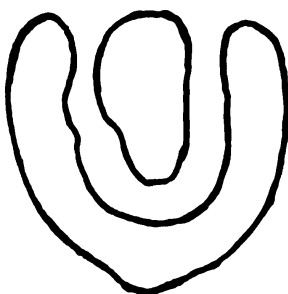


Figure 2.—The doughnut patella; this one is always much larger than its fellow.

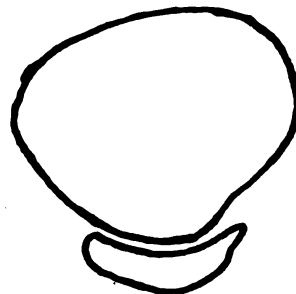


Figure 3.—The transverse fissure occurs in the upper end of lower pole.

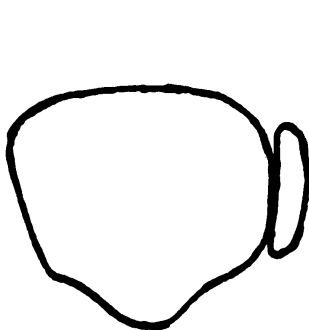


Figure 4.—The fissure is vertical; this line may be a fracture.

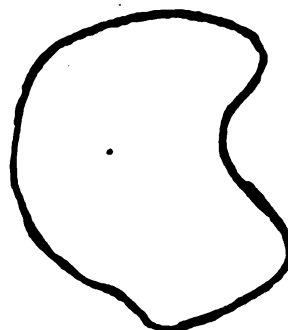


Figure 5.—The emarginate type. The emargination is in the upper quadrant, either medial or lateral.

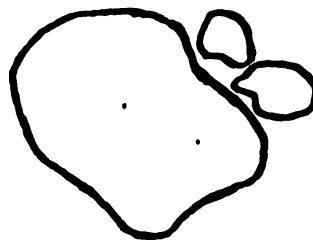


Figure 6.—The multipartite type.

The diagnosis of the condition is not difficult. A careful history of the accident is most important. Did the patient strike the "knee cap" directly on the "front" and on what type of surface was the knee struck? Did something in the knee snap and then did the patient fall, or did the patient fall and then feel something snap?

The physical examination usually reveals no gross abnormalities. Swelling of some degree is usually present. The extreme point tenderness of a fracture is noticeably absent. The presence of fluid within the joint is not remarkable nor is it consistent, as this is so commonly found following any severe trauma to the knee. Commonly, a defect can be palpated, but this finding cannot be relied upon

too much, as a rupture of the capsule of the bone can impart the same impression to the examiner. From a functional point of view, these patients usually present a minor degree of disability, compared with the greater loss of function in true fractures. Positive evidence of the condition can be gained from radiographs, particularly those taken in the postero-anterior position. The space between the fragments is uniform and does not show the serration that is seen in fractures. The position of the detached fragment is very consistent: that is, the smaller bone in usual bipartite types, is the upper outer one. Comparative studies of the opposite knee do not help unless the condition is present. There appears to be no correlation whatsoever between unilateral or bilateral incidence. If doubt still exists in the mind of the examiner, radiographs in 2 months should verify the diagnosis of fracture.

CASE REPORTS

Case 1.—W. R. S., F1/c, x-ray no. 27085, admitted 21 February 1946 with diagnosis Fracture, simple, right patella. Had sustained a minor injury to knee 3 February 1946. No physical findings of clinical significance. Discharged to duty 6 days later (fig. 7).

Case 2.—W. G. M., S1/c, x-ray No. 26163, admitted 23 January 1946 with diagnosis, Fracture, simple, left patella. Patient had struck knee on dashboard 8 days previously and had moderate disability. Discharged to duty 10 days later (fig. 8).



Figure 7.—Case 1.



Figure 8.—Case 2.

Case 3.—R. L. J., Sm2/c, x-ray No. 27393, admitted 2 March, with diagnosis Fracture, simple, left patella. He had suffered a shipboard fall and had been on the sick list 70 days prior to admission. Complete immobilization had been carried out during the entire 70 days. Discharged to duty 9 days later (fig. 9).

Case 4.—O. J. L., S1/c, x-ray no. 28339, admitted 5 April 1946 with diagnosis Fracture, simple, left patella. This patient fell while roller skating, had walked back to his ship and was seen by medical officer who admitted him the day following the accident. Discharged to duty 5 days later (fig. 10).

*Figure 9.—Case 3.**Figure 10.—Case 4.**Figure 11.—Case 5.*

Case 5.—P. A. S., S1/c, x-ray no. 28603, admitted 17 April 1946, with diagnosis Fracture, simple, left patella. Had sprained knee playing basketball 3 weeks prior to admission. Discharged to duty 6 days later (fig. 11).

Case 6.—J. F. P., Wt3/c. Admitted 5 April 1946 with diagnosis Fracture, simple left patella. Had fallen and struck knee on stanchion 1 week prior to admission. Discharged 1 week later.

SUMMARY

Five cases of unilateral bipartite patellae are presented. All had been previously diagnosed as fractures. A brief summary of the literature is reviewed, along with case reports and radiographs. In any suspected fracture of the patella, a history of moderate injury with little functional disability should immediately make one think of a congenital anomaly rather than a true fracture. If radiographs reveal a smoothly separated fragment, particularly if it is in the upper and outer quadrant, the diagnosis of bipartite patella should be considered.

REFERENCES

1. Tabb, J. L.; Faulkner, D. M.; and Smith, C. D.: Bipartite patella. *Virginia M. Monthly* 67: 475-478, Aug. 1940.
2. Kempson, F. C.: *J. Anat. & Physiol.* 36: 149: 1902.

3. Salmond, R. W. A.: Recognition and significance of fractures of patellar border. *Brit. J. Surg.* 6: 463, 1913.
4. Hawley, G. W., and Griswold, A. S.: Larsen Johansson's Disease of the Patella. *Surg., Gynec. & Obst.* 47: 63, 1943.
5. Leviaseb, J. S.: Bipartite patella. *Ann. Surg.* 94: 150-154, July 1931.
6. Adams, J. D., and Leonard, R. D.: Developmental anomaly of patella frequently diagnosed as fracture. *Surg., Gynec. & Obst.* 41: 601-604, Nov. 1925.
7. Smith, L. D.: (Milwaukee) Patella bipartite. *New England J. Med.* 212: 331-335, Feb. 21, 1935.
8. Cunningham, D. J.: Textbook of Anatomy. 7th edition. Oxford University Press, New York, N. Y., 1937.



A STUDY OF THE EFFECT OF BREATHING OXYGEN OR NORMAL AIR AFTER EXPOSURE TO AN ATMOSPHERE HAVING A HIGH CONCENTRATION OF CARBON DIOXIDE

ROBERT HAYTER ¹

Lieutenant Commander (MC) U. S. N.

and

GERALD J. DUFFNER

Lieutenant Commander (MC) U. S. N.

THE efficiency of personnel escaping from a submerged submarine may be greatly affected by the composition of the air in the submarine. For example, the mental confusion, dizziness, nausea, and dyspnea caused by high carbon dioxide may disrupt the discipline and morale necessary to execute a swift and orderly escape, and some men may be so incapacitated as to be unable even to attempt an escape. Furthermore, it has been known for many years that when a person breathes normal air after breathing an atmosphere high in carbon dioxide, severe headache commonly occurs and occasionally nausea and vomiting (1). Following prolonged submergence the change to normal air may adversely affect the efficiency of the personnel.

In brief experiments carried out to determine why so few men escaped from the British submarine *Thetis* it was found that oxygen was also capable of producing symptoms in men who had been in an atmosphere containing 6 to 7 percent of carbon dioxide (2).

It was therefore considered advisable to conduct a study in which the symptoms mentioned above would be reproduced by exposure of subjects in a recompression chamber to an atmosphere having a high concentration of carbon dioxide and subsequently to oxygen or to normal air. The principal objective was to discover whether air or oxygen had the greater effect on the subjects.

PROCEDURE

The experiments were conducted in a recompression chamber the capacity of which was 190 cubic feet. Twenty-two men, 18 to 38 years of age, were volunteer subjects. Usually four or five subjects

¹ Resigned 15 December 1947.

were in the chamber, but in some experiments there were three or six. The total number of man-exposures was 110.

In 12 of the 25 experiments the men exercised on a stationary bicycle in order to cause a relatively rapid increase in the concentration of carbon dioxide in the air. In 13 experiments the carbon dioxide was raised to the desired concentration of 5 to 7 percent by releasing 75 pounds of the gas from a cylinder during the first 30 minutes of the experiment.

The exercise experiments lasted 4 hours and the experiments in which carbon dioxide was released lasted 1 to 3 hours. The men took turns riding the bicycle. The total time of bicycle riding varied from 80 to 120 minutes.

In 12 of the exercise experiments and 4 of the nonexercise experiments the pressure in the chamber was 200 mm. Hg. greater than barometric pressure because it was believed that this would prevent leakage around the edge of the chamber door. However, it was finally decided that small leaks were unimportant in experiments in which one was studying the effect of carbon dioxide and not the rate of production of carbon dioxide by man. Consequently, in the later experiments the chamber exhaust valve was left open; as a result the pressure in the chamber was barometric.

At the end of 17 of the 25 experiments (76 man-exposures) the subjects left the chamber and breathed room air. At the end of 5 of the experiments (20 man-exposures) oxygen was breathed. In 2 of the 5 the subjects used a submarine escape appliance charged with oxygen and in 3 of the 5 oxygen was breathed from a demand system in which rebreathing was impossible. When the escape appliance was used the oxygen was diluted by the nitrogen eliminated from the body during exhalation but when the demand system was used there was no dilution. The duration of oxygen breathing was 10 minutes in 1 experiment, 34 minutes in another, and 15 minutes in the 3 remaining experiments.

At the end of 3 experiments (14 man-exposures) the chamber was thoroughly ventilated with compressed air to clear it of carbon dioxide. The pressure was then increased at a uniform rate to 59.2 psi. absolute in 4 minutes, maintained for 15 minutes, and then reduced to atmospheric at a uniform rate in 5 minutes. After the pressure was reduced to atmospheric the subjects left the chamber and breathed room air.

During and after all the experiments a medical officer asked the subjects whether they had any symptoms; e. g., headache, dizziness, nausea and vomiting; during most of the experiments a medical officer was with the subjects to observe them and, by experiencing the symptoms himself, was able to interpret them more accurately.

In all the experiments the concentration of carbon dioxide was measured at least half hourly with the Dwyer carbon dioxide indicator. At the conclusion of each experiment a sample of the chamber atmosphere was taken in a gas-sampling tube and was analyzed for carbon dioxide and oxygen in the Haldane apparatus. In the experiments in which the chamber pressure was 200 mm. Hg. greater than atmospheric the carbon dioxide and oxygen were recorded as percent effective. For example, 6 percent would be 7.5 percent effective

$$\left(\frac{960}{760} \times 6 = 7.5\right)$$

RESULTS

TABLE 1

Final percent carbon dioxide	Number of man-exposures	Man-exposures with symptoms	
		Number	Percent
4-4.9	20	2	10
5-5.9	12	6	50
6-6.9	43	35	81
7-7.9	27	25	93
8-8.9	8	8	100

The table shows that when the concentration of carbon dioxide exceeded 5 percent a significant number of men had symptoms. In the men who had symptoms, headache was invariably present and was nearly always the only symptom. In the carbon dioxide range of 5-5.9 nausea occurred once and in the range 7-7.9 it occurred three times, vomiting once, and chills three times. When the final concentration of carbon dioxide was above 7 percent almost every subject was dizzy and mildly confused. The headaches usually began while the subjects were in the chamber and became more severe when they breathed room air.

When oxygen was breathed the headaches usually became worse, then decreased or disappeared during the breathing of oxygen, and when room air was breathed, recurred mildly or not at all. However, one subject whose headache disappeared during the oxygen breathing had a severe recurrence when he breathed room air. One man experienced headache, nausea, and abdominal pain while breathing the atmosphere containing carbon dioxide. When he breathed oxygen the nausea and abdominal pain disappeared and the headache increased in severity and then disappeared before the end of the oxygen breathing.

In the experiments in which the chamber was ventilated with compressed air and the pressure then increased to 59.2 psi. absolute, the

headache as a rule became more severe during the ventilation, disappeared during the period of compression and did not recur when the pressure was restored to atmospheric. However, in two men the headache decreased during the compression and, when room air was breathed, became as severe as before the compression.

When the subjects left the chamber and breathed room air the average duration of the headache following departure of the men from the chamber was $2\frac{1}{4}$ hours but, as has been noted, when oxygen was breathed or the pressure was increased to 59.2 psi. absolute, the headache decreased or, more commonly, disappeared within 15 minutes.

In the oxygen breathing experiments there were 3 man-exposures in which the final carbon dioxide percent was 5 to 5.9, 9 man-exposures in which it was 7 to 7.9 percent, and 8 in which it was 8 to 8.9 percent. In the 14 man-exposures in which the pressure was raised to 59.2 psi. absolute the final carbon dioxide percent was 6 to 6.9.

The lowest final concentration of oxygen during the exercise experiments was 16 percent effective and the highest 20 percent effective; in the non-exercise experiments the lowest was 22 percent effective and the highest 25 percent effective.

DISCUSSION

Haldane, et al. (2) stated it was probable that the men in the *Thetis* suffered from headache and/or vomiting on breathing pure oxygen in their escape apparatus. They attributed these symptoms to the sudden fall in the concentration of the carbon dioxide and not to the rise in the concentration of the oxygen breathed. Our results also show that a sudden fall in the concentration of carbon dioxide is followed by the appearance or exacerbation of the usual symptoms. However, as already pointed out, the headache lasted a much shorter period of time following the inhalation of oxygen than when air was breathed. We are unable to explain the difference in duration of the symptoms and have been unable to find an explanation in the published reports.

Brown reported that in 8-hour chamber experiments in which the final concentration of carbon dioxide was 5.6, 5.7, and 5.8 percent and the oxygen 16.1, 15.4, and 14.2 percent, two of six subjects were seized with such dizziness, nausea, and dyspnea during the seventh hour of one of the three tests that it was necessary to release them from the chamber (3). After the experiment there was persistent fatigue. The physiological effects were so severe that it was not considered advisable to expose the subjects to higher concentrations of carbon dioxide. A wide individual variation in the type and severity of symptoms was noted and this phenomenon was observed in our experiments.

When Brown introduced oxygen into the chamber so that its final concentration was between 18.5 and 21.5 percent and as before permitted the carbon dioxide to rise to between 5.5 and 6 percent, headache, dyspnea, and exhaustion were less. However, he concluded the differences were not uniformly distinct and striking and that keeping the oxygen high did not relieve the situation to the extent that exposure to increased concentrations of carbon dioxide were considered justified.

Comparing our results with Brown's, it is evident that although the carbon dioxide did not reach 5 percent until the sixth to seventh hour of Brown's experiments, exposure to a concentration of carbon dioxide of 5 or 6 percent for 1 to 4 hours was less incapacitating than when the experiments lasted 8 to 10 hours. It would be expected that the longer the hyperpnea and headache the greater the reduction of efficiency. In our experiments, dizziness, chills, and mental confusion were not common unless the carbon dioxide exceeded 7 percent.

Other observers found that in two submarines in which the air was recirculated for from 50 to 60 hours with the result that the concentration of carbon dioxide reached 5 percent, 16 of 34 men in one boat had headache and 2 of 34 had nausea; and in the other boat 18 of 76 had headache and 8 of 76 had nausea. In laboratory experiments conducted in a sealed compartment headache and dizziness when fresh air was breathed were common in observers who had breathed the compartment atmosphere, which contained approximately 5 percent of carbon dioxide, for 1 to 2 hours.

SUMMARY AND CONCLUSIONS

Twenty-five experiments were performed in a chamber in which men were exposed 1 to 4 hours to an atmosphere containing carbon dioxide whose final concentration varied between 4 and 9 percent. In 12 of the experiments the carbon dioxide was increased by exercise on a stationary bicycle and in 13 it was released from a cylinder.

At the end of three of the experiments the chamber was ventilated with compressed air and the pressure in the chamber was then increased to 59.2 psi. absolute. At the end of 5, oxygen was breathed, and in 17 experiments the men left the chamber and breathed room air.

In the men who had symptoms, headache was invariably present and was nearly always the only symptom. When the final percent of carbon dioxide was above 7 almost every subject was dizzy and mildly confused. When the final percent of carbon dioxide exceeded 8 every subject had symptoms. In all the experiments nausea and vomiting were uncommon.

When the subjects left the chamber and breathed room air the average duration of the headache was $2\frac{1}{4}$ hours but when the pressure was

increased or when oxygen was breathed the headache decreased or disappeared within 15 minutes.

REFERENCES

1. HALDANE, J. S., and SMITH, J. L.: Physiological effects of air vitiated by respiration. *J. Path. & Bact.* 1: 168-186, 1893.
2. ALEXANDER, W.; DUFF, P.; HALDANE, J. B. S.; IVES, G.; and RENTON, D.: After-effects of exposure of men to carbon dioxide. *Lancet* 2: 419-420, Aug. 19, 1939.
3. BROWN, E. W.: Value of high oxygen in preventing physiological effects of noxious concentrations of carbon dioxide. *U. S. Nav. M. Bull.* 28: 523-553, July 1930.



A DYSENTERY OUTBREAK ABOARD A CRUISER IN APRA HARBOR, GUAM, MARIANAS ISLANDS

ROBERT A. MOUNT
Commander (MC) U. S. N.

and
THOMAS M. FLOYD
Lieutenant Commander (MSC) U. S. N.

DURING June and July of 1947 an outbreak of dysentery of 4 week's duration occurred aboard a cruiser lying in Apra Harbor, Guam, Marianas Islands. The outbreak was of an explosive nature due to mass infection and reached its peak at the end of the first week. Thereafter for 3 weeks the case rate gradually declined and only sporadic cases and relapses have been reported by the ship since its departure from this area.

This cruiser had had occasional cases of diarrhea, lasting for 24 to 48 hours, over a period of several months, and while in Pearl Harbor in April had had approximately 90 percent of the crew cultured for the detection of possible carriers of dysentery. Six positives for *Shigella flexneri III* were found at that time.

Between 22 June 1947 and 15 July 1947 a total of 326 cases of dysentery occurred, of which 255 were transferred ashore to the U. S. Naval Hospital, Guam, for isolation and treatment, while the remaining 71 were treated aboard ship. Asymptomatic cases and mild cases suppressed by sulfadiazine prophylactic therapy brought the number to well over 350 cases. The effects of the incapacitation of 45 percent of the crew of 942 officers and men on the operations of the ship may be readily surmised. It is estimated that in excess of 5,000 man-days were lost as a result of the epidemic.

This report is concerned with the detection of the etiological agent, some clinical observations on the cases, the epidemiology of the outbreak and the control measures instituted.

ETIOLOGY

It was early and readily determined that the causative organism of the outbreak was *Shigella flexneri III*. Of the initial 15 men trans-

ferred ashore to the Naval Hospital, 12 gave positive anal swab cultures for this organism on the first attempt at isolation. Anal swab cultures were routinely plated on DIFCO SS agar plates and slide agglutinations were done on suspicious nonlactose fermenting colonies with Flexner polyvalent serum. Further confirmation, in the event of positive agglutination reactions, was obtained from Russell's double sugar slants, sugar broth reactions, and specific typing sera.

A total of 1,845 swab cultures were made on food handlers, hospitalized patients, and galley equipment. There were 76 positive cultures from 586 men, or 12.9 percent. (See table 1.)

TABLE 1

	Number cultured	Total cultures	Positive Sh. alk. ¹	Positive Sh. flex. ²	Percent pos. Sh. flex. III
Food handlers.....	139	516	12	11	7.81
Sick bay patients.....	97	249	3	26	26.80
Hospital patients.....	350	1,026	10	39	11.14
Galley machines.....		54	10	0	0.00
Total.....	586	1,845	35	76	12.96

¹ *Shigella alcalescens*.

² *Shigella flexneri* III.

It is felt that 7.81 percent positives among the food handlers represents more or less of a true picture of the carrier situation aboard the ship at the time of the outbreak, since these cultures were taken on apparently healthy individuals who had not come down with the disease as a result of the original mass infection.

In all probability, moreover, the percentage positives among the patients would have been many times higher had we been able to culture them before treatment was started. Since the primary objective was to bring the epidemic under control, our efforts were concentrated on combating further contact spread among the crew rather than on patients who already had the disease. Because of this necessity, approximately 65 percent of the patients had received or were receiving a full course of therapeutics or prophylactic sulfadiazine therapy before we were able to take the first cultures.

Of interest, and subsequently to be of significance, was the number of positive cultures of *Shigella alcalescens* isolated during this study. A total of 35 isolations were made, of which 25 were from anal swab cultures and 10 were from galley and scullery machines.

CLINICAL OBSERVATIONS

The outbreak was of an explosive nature and the sudden influx of large numbers of patients precluded detailed written studies on

all cases. Table 2 summarizes the clinical findings on 297 of the patients.

TABLE 2

Symptoms recorded	Number reporting	Percent	Symptoms recorded	Number reporting	Percent
Diarrhea.....	269	90.5	Tenesmus.....	143	48.1
Blood in stool.....	44	14.8	Nausea.....	122	41.0
Mucus in stool.....	50	16.8	Vomiting.....	76	25.5
Pus in stool.....	27	9.0	Headache.....	231	77.7
Watery stool.....	262	88.2	Fever.....	273	91.9
Abdominal cramps.....	252	84.8			

The onsets were generally sudden with the most common complaints being those of abdominal cramps, fever, and loose, multiple stools. Some of the early cases, however, came in with only headaches, cramps, and slight temperatures, while others complained only of diarrhea.

The stools rarely contained blood or pus, although this in most instances depended entirely upon the observant nature of the patient. Mucus was even more rare (6.5 percent) prior to the sulfadiazine suppressive therapy. After this program was begun, 36 out of 83 cases (43.3 percent) reported mucus in their stools. This again may have been a matter of observation or of interrogation.

Headache was a common complaint and most cases were slightly febrile upon admission and temperatures increased markedly during the first 24 hours. During the course of the disease the fevers ranged from a few tenths elevation to several at 105° F., with one being reported at 107° F. Temperatures usually returned to normal by the end of the third or fourth day.

Tenesmus was present in about half the cases (48.1 percent) and nausea in slightly less (41.0 percent). Only a fourth vomited and most of these only once, though one patient reported vomiting 15 times and several 5 or 6.

Some patients with fairly acute symptoms had relatively few stools while others in a less severe category had practically no control over their bowels. In general between 10 and 15 stools a day were the average. In one case 40 were recorded in one 24-hour period.

Most patients were clinically well within 1 week. Those admitted to the hospital were kept 16 or 17 days, on the average, because 5 days were allowed to elapse after their last medication before the first cultures were taken to prove their stools free from the dysentery organisms. Three negative stools, taken on alternate days, were the criteria for release. Patients on board ship were kept for shorter periods of time.

No adverse sequela was reported, except in the case of the patient with the temperature of 107° F. who had a mild toxic psychosis.

TREATMENT

All patients upon admission to the hospital or sick bay were placed upon sulfadiazine, 2 grams immediately and 1 gram every 4 hours for 7 days. An equivalent amount of sodium bicarbonate was administered at the same time. During the acute diarrheal phase all received bismuth and paregoric, 3 times a day.

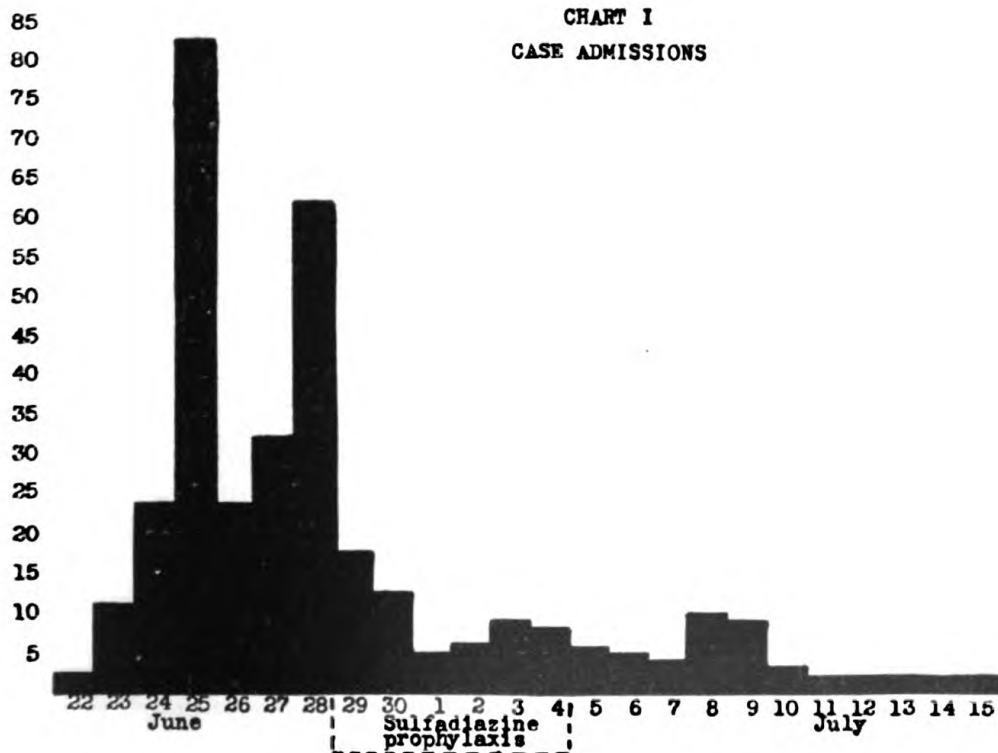
All patients with temperatures of 101° F. or more upon admission received intravenous fluids of 5 percent dextrose in saline, 1,000 cc. 3 times a day. Approximately 50 percent of the hospital patients were in this group.

Thirty-three patients showed cultural relapses 5 days after cessation of medication. These were placed upon a regime of 2 grams sulfaguanidine every 4 hours, 1 gram sulfathiazole every 4 hours, and 1 gram sodium bicarbonate every 4 hours, all for 7 days. There were no relapses during the subsequent period of culturing. In a later communication from the ship at Long Beach, 6 additional relapses have occurred among hospitalized patients returned to duty.

There were no sulfa intolerances noted among the hospitalized patients and ward medical officers reported good responses.

A small group of 13 men receive 1 gram of streptomycin by mouth 3 times a day for 3 days in addition to the initial sulfadiazine therapy. There were no relapses in this group.

CHART I
CASE ADMISSIONS



EPIDEMIOLOGY

During the first several days of the outbreak the large number of cases occurring in a short period of time, 122 during the first 4 days, made it apparent that we were dealing with infection from massive contamination. (See chart 1.) No matter how short the incubation period of bacillary dysentery might be, it hardly seemed possible that contact infections could occur so rapidly in such a short period of time.

There was no lack of possible sources of contamination. As stated earlier, the ship had had cultures taken on approximately 90 percent of the crew in April while in Pearl Harbor. Six positives for *Shigella flexneri III* were picked up. Serial cultures no doubt would have revealed closer to our 7.8 percent, since *Shigella* carriers often secrete the organisms very sporadically. In addition, the ship had received men from other ships who had recently experienced dysentery outbreaks. Among the patients alone 16 reported having been in dysentery outbreaks during the past year aboard ships at Bikini, in Japan, and ashore in China. This then constituted an ideal reservoir of infection, either through contact or through massive contamination of some item of common usage.

The harbor water came under suspicion from the beginning. Apra Harbor has long been known to be heavily contaminated with sewage. Winds and tides in this harbor are slight and the sea water exchange is negligible as evidenced by the debris and sewage floating on the surface of the water. Water samples taken in the harbor during a previous dysentery outbreak aboard three cruisers uniformly showed gross fecal contamination, and at the height of that epidemic we were able to demonstrate *Shigella flexneri III* organisms several hundred feet off the ships. Cheever,¹ working on an outbreak in the Philippines, showed *Shigella flexneri III* organisms to be capable of surviving in sea water for 76 hours.

Several weeks previously a floating dry dock lying in the harbor had had a mild outbreak of 36 cases of diarrhea of undetermined origin. Though this was not demonstrated to be due to Flexner organisms the presence of its sewage lent further suspicion to the harbor water.

Samples taken at varying distances from the ship on the second day of this investigation did not reveal Flexner's bacilli but did show gross fecal pollution as evidenced by positive coli-aerogenes cultures. With evidence that the ship was lying in contaminated water and knowing that there were proved carriers aboard to seed the sewage, our attention was turned to possible sources of contamination from sea water.

¹ Cheever, F. S.: Dysentery outbreak aboard naval vessels in San Pedro Bay, Philippine Islands. U. S. Nav. M. Bull. 46: 479-494, Apr. 1946.

A thorough investigation of the records of the fresh water distilling system failed to show any recent increase in the salinity of the water during the conceivable incubation period. The chance for sea water to pass through the distillers always exists, since by using a low pressure evaporator it is possible to lower the pressure to a point where the water boils at a temperature considerably lower than 212° F. Usually, however, it does not fall below 180° F. From the evidence at hand dysentery organisms are not considered capable of surviving this temperature. Repeated analyses of the fresh water supplies failed to show the presence of organisms of the coli-aerogenes group.

The use of sea water for swabbing down decks was considered another possibility. An analysis of case incidence by divisions did not support this since the incidence in the deck divisions was not appreciably different from any other. (See table 3.)

TABLE 3

Division	Number of cases	Percent of total cases	Division	Number of cases	Percent of total cases
A.....	15	5.0	S.....	30	10.1
B.....	22	7.4	T.....	5	1.6
C.....	15	5.0	V.....	1	.3
E.....	15	5.0	1st.....	21	7.0
F.....	25	8.4	2d.....	26	8.7
H.....	4	1.3	3d.....	13	4.3
I.....	12	4.0	4th.....	13	4.3
M.....	17	5.7	5th.....	25	8.4
N.....	3	1.0	6th.....	20	6.7
R.....	12	4.0			

The few numbers involved in such divisions as H, N, and V may be attributed to the size of these divisions (medical, quartermaster, and aviation), while the greatest number occurring in S Division (food handlers) is due to the fact that men were transferred from other duties to keep this division up to full strength throughout the epidemic. The more or less equal distribution of cases throughout all divisions lent further support to the theory of mass infection.

A constant check had been maintained on the chlorination of the drinking water and 2 parts per million were being maintained at all times. Our own chlorine determinations substantiated this during the outbreak.

Concurrently with the investigations on sea and fresh water, the galleys aboard ship were being studied as possible sources of mass infection. As the numbers of cases rose, it became strikingly apparent that during the first 5 or 6 days they were restricted exclusively to the enlisted men eating in the enlisted men's mess. It was not until late in the epidemic, when contact infections were common, that the first officer and chief petty officer came down with the disease. Also equally striking was the fact that the enlisted men working in the

four messes other than the general mess had not come down with dysentery. Approximately 40 men were serving as mess cooks or stewards mates in the cabin, officers, warrant and C. P. O. messes. With the cases being distributed evenly throughout all divisions this immediately centered attention on the enlisted men's mess as being the focal point of infection.

Food handlers in this mess were under suspicion because the existence of carriers on board had already been proved. Eventually during a series of five cultures on all food handlers, eight men were found to be harboring *Shigella flexneri III* organisms.

During the course of these serial cultures, attempts were made to isolate the organism from various pieces of equipment in the galley and scullery. Though no Flexner organisms were picked up, we were able to isolate *Shigella alkalescens* with regularity from drain boards, swabs, pans, and from potato peeler, milk mixing, bread slicing, and meat grinding machines. This was very suggestive evidence since we were recovering this organism frequently from anal swab cultures on patients.

The galley and scullery presented a clean, well-ordered appearance and every effort was being made to comply with existing sanitary regulations. Certain minor irregularities, such as stacking benches on mess tables, picking over the silver by men in mess lines and inadequate hand washing by food handlers, were remedied as quickly as they were pointed out.

The ability to isolate organisms indicative of fecal contamination throughout the galley and scullery supported the theory that mass infection of an article of common usage rather than carrier contamination, since it was not likely that one man, or even several men, would be handling so many diversified pieces of equipment. Our attention therefore was turned to possible cross connections and back flows in the water and drainage systems of the galley and scullery.

Upon investigation it was found that considerable trouble had been encountered previously with the dishwashing machine in that galley and that recently a salinity check had been maintained on the water in its wash and rinse tanks. On the fifth day of this investigation a salinity determination revealed 22 grains per gallon, which indicated a backflow of sea water since the normal salinity of the ship's water was around 0.4 grains per gallon. The use of this machine was immediately discontinued. Further investigation and information from the engineering department disclosed that failure of the operator of the dish washing machine to tightly close the drain valves, along with a reduction in the fire main pressure, would allow a head of flushing water to accumulate in the drain and seep into the machine's tanks which were on a deck below the eductor outlet. Engineering records

showed that as much as 60 grains per gallon of salt had been discovered in the tanks upon several occasions. It was also noted that the valve was so located that it could be loosened easily by being brushed by the clothing of galley workers going by.

Further incriminating evidence against the dishwashing machine was the fact that all other messes, other than the warrant officers mess, were located on the deck above and their drains were on the same level as the eductor outlet, thereby preventing backflow during a loss of pressure. The warrant officers mess did not use a mechanical dishwashing machine.

Since all the cases during the first 5 days of the epidemic were restricted to only those men eating in the general mess, and since the few cases that did occur in the other messes later (14 percent of the officers, 10 percent of the warrant officers and 15 percent of the C.P.O.'s as contrasted with 45 percent of the crew) could have been contracted entirely through contact, and since backflow of sea water was demonstrated before, during, and after the outbreak into the mechanical dishwashing machine in the general mess, it was felt that we had almost conclusive evidence that the initial mass infection came from this machine.

CONTROL MEASURES

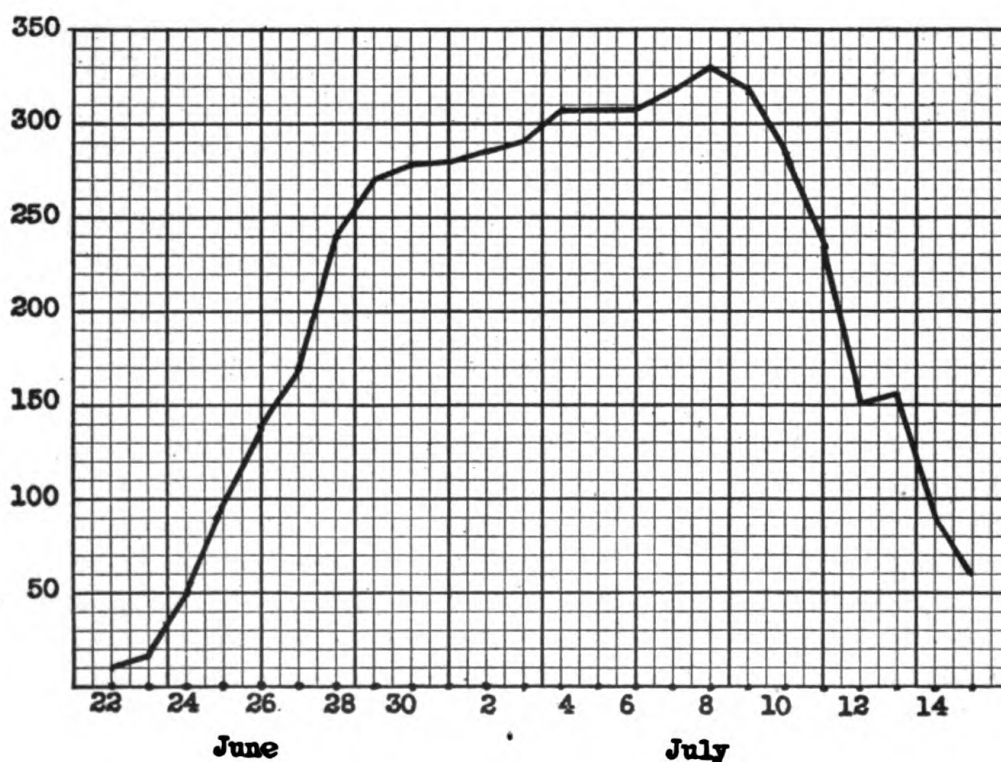
The control measures commonly associated with enteric outbreaks were placed in effect by the ship's medical department from the onset. Head watches were established to see that all personnel washed their hands with soap and water and dipped them in disinfectant solution prior to leaving the head. Toilet seats were swabbed with disinfectant. Rails, ladders, and other articles commonly touched by many hands were swabbed with disinfectant three times a day. The use of sea water for any purpose other than flushing heads was discontinued. Coffee messes were closed. There was no visiting between this ship and other ships or the shore. Food handlers were restricted to their own duty stations. No articles could be exchanged between messes and galleys. Only assigned mess cooks were allowed to serve food. Silverware was handed to men in mess lines. Trays were air-dried. Mess cooks were required to dip their hands in disinfectant at intervals and upon entering the messing spaces. Mess tables were swabbed with disinfectant. Utensils were rinsed in disinfectant and air-dried.

In addition, other measures were suggested and instituted to stop any possibly overlooked gap in the sanitary precautions. The ship's library was closed, reading was stopped in the heads, the daily cleaning bill in messes and living spaces was more vigorously applied and the frequency of inspections by medical department and division officers of these spaces increased. Instruction in the cause and prevention

of the disease was repeatedly delivered to the crew over the public address system by both the Captain and the Medical Officer in extremely simple language.

Due to the explosiveness of the onset, the facilities of ship's medical department were soon overtaxed and arrangements were made to transfer all cases, carriers, and suspects to the Naval Hospital for treatment and convalescence. The removal of these personnel undoubtedly lessened the amount of contact infection that occurred throughout the ship. (See chart 2.)

CHART II
NUMBER ON SICK LIST



On 29 June 1947, or the eighth day of the outbreak, it became apparent that the epidemic would not soon run its course. In the hope of decreasing the spread, a course of sulfadiazine for 6 days was prescribed for the entire crew. An initial dose of 2 grams was given, followed by 1 gram every 4 hours. Two grams were given in the evening to maintain the sulfa level over night. Each gram of sulfadiazine was accompanied by 2 grams of sodium bicarbonate. Intolerances were rare though headache and lethargy resulted in a few instances. This abated upon removal of the drug. Some reported pain over the renal area but only three showed hematuria which quickly cleared upon cessation of therapy.

The value of the sulfadiazine prophylactic course is problematical. As visualized on chart 1 it would appear to have drastically cut the number of cases. However, the day that the program was instituted was the 10th day of the outbreak and may well have been the end stages of the incubation period of those cases resulting from the initial mass infection. In addition, the decrease in the number of susceptibles among the crew at that stage of the epidemic must be taken into consideration.

Certain disadvantages resulting from the sulfa program appeared before the conclusion of this study. Difficulty in clearing up some of the later cases might be attributed to the development of a sulfa-fast strain of *Shigella flexneri* III. It was noted that cases appearing 4 to 6 days following sulfa therapy did not respond to sulfadiazine, while all but two responded to sulfaguanidine. Of equal importance was the psychological effect of the program on the control measures. There appeared to be a feeling that the drug was a "cure-all," resulting in a general relaxing in the observance of the measures. However, at the time the course was instituted it seemed advisable under the conditions that existed.

SUMMARY

During the months of June and July of 1947 an outbreak of dysentery occurred aboard a cruiser in Apra Harbor, Guam, Marianas Islands. A total of 326 cases were reported. The etiological agent was *Shigella flexneri* III.

The original source of infection was apparently the dish washing machine in the crew's galley. Faulty operation of a valve and lowering of the pressure in the main resulted in a back flow of sea water from the eductor system into the wash and rinse water tanks of the machine.

Carriers were proved to be aboard capable of seeding the ship's sewage with the organisms, and the harbor water is known to be grossly polluted, thereby offering ample opportunity for the salt water system to carry *Shigella flexneri* III.

Personal contact played an important part in the spread once the epidemic was underway.

Sulfadiazine was given to all hands as a prophylactic measure. This may have assisted considerably in bringing the outbreak under control.



TREATMENT OF ACUTE SACROCOCCY- GEAL CYST TERATOMA

JESSE F. ADAMS
LIEUTENANT (MC) U. S. N.

IT IS almost a universal practice to relieve an inflamed cyst teratoma by incision sufficient only to allow drainage for a short time.

A short series is presented which was treated with wide incision. This method was proposed to the writer by Clegg (1). Prior to this the writer's usual treatment was to incise minimally and wait for subsidence of the inflammation, then perform an excision and closure. The results of this conservative first management and later excision were somewhat disappointing from the standpoint of prolonged hospitalization and the not infrequent failure of closures.

The form of treatment to be discussed is mentioned briefly by Van Dyke (2) with the comment that this is a modification of the marsupialization treatment of Buie (3). This writer disagrees in that the marsupialization treatment demands that there be epithelium remaining in the cyst sufficient to form skin covering for it, while in this procedure reliance is placed on the fact that the epithelial lining is largely destroyed by infection and that healing by granulation occurs and epithelization is accomplished by the adjacent skin.

In the period from 3 March 1946 to 3 August 1946 only 11 cases of the 36 cases of cyst teratoma admitted during this period were suitable for the type of treatment to be described, the others having been treated conservatively and unoperated, or previously operated with recurrence (in 1 case 5 times). It is believed that had these conservatively treated cases been incised in the manner to be described that the recurrence rate as well as the disproportionate number of sick days incident to cyst teratoma suffered by these cases would have been materially lessened.

The procedure is suitable only at the time of first inflammation without sinus formation. At the time of admission the cyst is usually acutely inflamed, but may or may not be sufficiently well localized to permit incision and drainage. In the event that adequate localization has not occurred, local moist warmth and intramuscular penicillin are used until the area is fluctuant and well localized. Superficial point-

ing of the abcess is not necessarily a criterion for incision since pointing may occur in the deeper tissues.

Following localization the patient is anesthetized with sodium pentothal and preparation is done at this time with the patient in a lateral Sims' position. The area is usually too painful to permit preparation prior to anesthesia.

An incision is made which extends the entire length of the abcess and the purulent material within evacuated. Any hair or other foreign matter is usually lying free within the cavity, the epithelial lining having been destroyed by the infection. If any epithelium is present it is curetted out. The cavity is then packed lightly with iodoform gauze and enough gauze is allowed to protrude to prevent the skin edges from coming together. Ligation of bleeding points is usually not necessary, hemostasis being accomplished by the packing.

The incision is redressed 2 days after operation and daily thereafter. The patient is allowed to be ambulatory as soon as he wishes and after the acute phase has subsided he is encouraged to perform useful work.

The after care is the most important part of the procedure. The wound must granulate in and epithelize without forming pockets or tunnels. This is prevented by packing with iodoform gauze and by unroofing incipient tunnels or by extending the mouths of pits by incision under procaine infiltration. When the danger of overgrowth of skin does not appear to be a problem the dressings are changed to balsam Peru, gauze still being tucked into defects.

When the wound has become shallow and uninfected the patient is allowed to shower and is directed to report for redressing of the wound immediately following the bath.

The average number of sick days for 10 of this series of 11 cases was 29.9 days, the extremes being 59 and 22 days, the eleventh case not being counted by reason of his transfer to another hospital 10 days after admission. Two of the ten cases were sent to duty under treatment after 10 and 17 sick days respectively. One case, a veteran, was discharged home after 8 days of hospitalization on the sixth postoperative day. He was seen approximately a week later following a fracture and has spent 5 months since either in bed or sitting, without discomfort or recurrence of the cyst.

One of the seven who remained until completely healed was a hospital corpsman on the ward where the series was collected. He was operated 2 days after admission and was helping with the work on the ward within a week after operation. He was allowed liberty 10 days after surgery and returned to full duty, healed, 20 days after surgery and has remained symptom-free. Two months after operation he was seen in the course of a routine physical examination for separation from the service and a scar about 1 millimeter in width and 2 centi-

meters in length, nontender, and not raised was seen at the site of incision.

In evaluating these cases, it must be remembered that the majority of these patients could not be discharged from the hospital until their incisions had completely healed, but had they been treated aboard ship or at the dispensary of a shore station, the majority of them could have been returned to full duty under treatment within a week after surgery.

No hesitation is felt in recommending wholeheartedly this form of treatment for acute cyst teratoma without previous history of draining sinuses or operative treatment.

It is desired to emphasize that minimal incision usually allows a sinus to form and is only the prelude to further exacerbations and loss of man-days.

REFERENCES

1. CLEGG, C. G. : Personal communication.
2. VAN DYKE, P. B. : Management of pilonidal disease. *Mil. Surgeon* 96: 420-422, May 1945.
3. BUIE, L. A. : *Practical Proctology*. W. B. Saunders Company, Philadelphia, Pa., 1937.



HEMORRHAGE ASSOCIATED WITH GASTRITIS

Review of the Literature and Report of Two Cases

IRVIN LEWIS CHIPMAN, JR.¹
Lieutenant (MC) U. S. N.

THE DIAGNOSIS of gastritis in any of its various forms has been made with increasing frequency since the middle of the last decade. The factor of importance in bringing this change about has been mentioned in previous articles (1) (2) to be the development and increased use of the flexible gastroscope (3).

In the case of gastro-intestinal hemorrhage, the cause of which is not readily apparent, gastritis as a cause of acute massive or minimal hemorrhage or insidious bleeding remains frequently overlooked. It is with this in mind that this article is written, and with the hope that in gastro-intestinal hemorrhage—melena or hematemesis—occurring in naval personnel or at naval stations, where the cause is not obvious, that gastritis with bleeding will be considered in the differential diagnosis. Following this, the relatively simple gastroscopic examination can be employed, if available, for confirmation by an individual experienced in gastroscopy.

As pointed out by Benedict (2), the earliest writers to report gastric erosions as a cause of hemorrhage were Langerhans and Nauwerck in the last decade of the last century.

Upper gastro-intestinal hemorrhage is a sign ordinarily attributed to peptic ulcer, but hemorrhage associated with gastritis is being reported with increasing frequency. It occurred once in 35 cases of Schindler, Ortmyer and Renshaw (4). Other authors report a larger incidence. Benedict (2) studied 20 cases of acute and chronic gastritis with hemorrhage by gastroscopy, and noted small erosions or superficial ulcerations in the majority of his cases. In another case series report by Benedict (5), hemorrhage occurred in 49 cases or 42 percent of the total cases reported, with hematemesis in 31 cases or 27 percent. Also, in a third report by Benedict (6), gastroscopic evidence of gastritis as the only source of bleeding was presented in 42 clinical cases, and in 24 additional cases gastritis was the possible source of hemorrhage. During the period of the latter series, 42 out

¹ Resigned 7 May 1947.

of 213 cases of gastritis or 19.7 percent were associated with bleeding, and of the 42 cases 9 showed suggestive roentgen examination signs of gastritis. The latter figure is consistent with other reports of correlative roentgenographic and gastroscopic findings, and all authorities are now of the opinion that in gastritis per se, gastroscopy is the most important diagnostic aid.

Schindler (7) reports on the experience of Piedre de la Vesca with gastroscopic examination following gross hemorrhage in 177 cases. In 10.16 percent of the cases reported, bleeding was attributed to gastritis. Fatal hemorrhages have been reported by Konjetzny (14), Korbisch (15), Schindler (7), and Bockus (18).

Pointed out by previous observers is the importance of taking a complete history relative to habits. It is frequent that the ingestion of alcohol will be found implicated in hemorrhage from the upper gastro-intestinal tract.

The exact frequency of bleeding associated with various forms of gastritis has not been definitely concluded. It is well known, however, as Bockus (8) points out, that hemorrhage appears to be more common in hypertrophic gastritis than in the atrophic or superficial varieties. Tumen and Lieberthal (1) report 6 cases in which hemorrhage associated with atrophic gastritis has occurred. It is further stated by Bockus (8) that gastro-intestinal studies in one-fourth of the cases of massive hemorrhage within 2 to 3 weeks after the cessation of bleeding fail to elicit any objective findings, which establishes unequivocally the exact site. It has been further stated (8) that "only after many gastroscopists have had the temerity to examine stomachs within 48 to 72 hours after hematemesis will the answer be given as to the percent of those due to gastritis."

CASE REPORTS

Case 1.—A 50-year-old white, male veteran was admitted to a naval hospital complaining of epigastric distress, melena, and vertigo. This patient was well until 1 month prior to admission, at which time he noted onset of burning epigastric pain appearing approximately 1 hour postprandially and relieved with sodium bicarbonate. About the same time, the patient noted his first tarry stool. He continued to work, and 4 days prior to admission he became nauseated following a meal, but did not vomit. The following morning on arising he noticed extreme weakness and vertigo. Following this, he became progressively weaker and the epigastric distress became more constant. There was no history suggestive of glossitis, paraesthesias, or difficulty in gait. Past history and family history were noncontributory. Industrial history was not significant, nor was the history relative to habits.

The temperature was 98.6° F.; pulse, 82; blood pressure, 140/60; respiration 20.

Physical examination on admission revealed a well-developed, well-nourished, white male, who exhibited marked pallor, and on moderate exercise became dyspneic. The remainder of the physical examination, including rectal and

neurological examinations, was negative, except that the liver edge was palpable to just below the costal margin, the edge being nontender and smooth.

A complete blood count done on the day of admission revealed 1,550,000 red blood cells; 6.5 grams of hemoglobin and 9,300 white blood cells with a normal differential count. Urinalysis and blood serology were negative. Other laboratory data of significance were as follows: Repeated stool studies for occult blood during the hospital stay were negative; blood studies including volume index, color index and red blood cell morphology were normal; reticulocyte response to a therapeutic trial of liver extract was 5 percent; liver function studies including bromsulfalein, cephalin flocculation and total proteins with albumin-globulin ratio were normal. The gastric analysis revealed no free hydrochloric acid in the fasting contents, but a rise to 22 units after the Ewald test meal. There was occult blood in the gastric contents and an abundant amount of mucus noted.

On the seventh day of admission a gastro-intestinal series was reported as revealing slight rigidity of the greater curvature of the antrum near the pyloric canal, but peristaltic activity passed through the area with only slight impairment. A repeat gastro-intestinal study done on the sixteenth day following admission revealed a negative gastro-intestinal tract.

On the twentieth hospital day a gastroscopic examination was performed with satisfactory visualization. The mucosa over the entire area visualized was congested and the rugae showed early nodularity. In the fundus were seen multiple small old petachiae. The mucosa generally was friable and bled easily with instrumentation. It was the gastroscopist's impression that this was a subsiding superficial hemorrhagic gastritis with early hypertrophic changes.

During the patient's hospital admission, he was treated with four whole blood transfusions, a bland diet reinforced with oral protein hydrolysate, antispasmodic and antacid therapy, and general supportive measures. The patient's red blood cell count rose progressively during the 25-day stay in the hospital, and on discharge was 4,500,000, with no symptoms and no significant physical findings, his symptoms having subsided following the first 10 days in the hospital.

Case 2—A 68-year-old veteran of the Spanish-American War was admitted to a naval hospital complaining of vertigo, weakness, anorexia, and weight loss. These symptoms began approximately 5 weeks before admission. Two weeks following the onset of complaints the patient was given a gastro-intestinal series by his private physician which was negative, and at that time a red blood cell count was reported to be 2,200,000. One week prior to admission, the patient noticed for the first time black tarry stools. There had also been a 15-pound-weight loss in the month prior to admission.

Systemic review, past, family, and habitual history were noncontributory.

His temperature was 98.6° F., pulse, 82; blood pressure, 104/70; respiration, 20.

Physical examination on admission revealed a slender, pallid, white male, appearing younger than his stated age, and weighing 125 pounds. The positive physical findings were: slight icteric tint to the sclera, aural perception slightly impaired bilaterally, a soft blowing apical systolic murmur, moderate epigastric tenderness, and a right varicocele.

Complete blood count on admission revealed 3,050,000 red blood cells, with 7.0 grams of hemoglobin; a white blood count of 6,400; icteric index of 31 units; and total proteins of 6.2 grams percent with an albumin-globulin ratio of .9/1.

The following special studies were done and the findings were normal: proctoscopic examination, barium enema, bone marrow biopsy, bromsulfalein and cephalin flocculation tests, red blood cell morphology with exception of slight anisocytosis and poikilocytosis, platelet count, red blood cell fragility, reticulocyte response to liver extract, color index, and chest x-ray.

A gastro-intestinal series performed revealed a large retentive duodenal cap with regurgitation in the duodenal loop and a slight gastric residue at the end of 5 hours. A gastric analysis revealed no free hydrochloric acid in the fasting contents, after the test meal or histamine injection. The total acid rose only to 10 units following histamine. Occult blood was markedly positive in the gastric contents.

Gastrosocopy performed approximately 30 days following admission revealed a stomach with hyperactive peristalsis and invagination of the pyloric mucosa. In the fundus the mucosa was atrophic and exhibited a prominent vessel pattern. Just above the angulus on the lesser curvature was seen a small amount of tenacious exudate with small superficial erosions.

Course in the hospital: The patient's entire stay in the hospital was 36 days. During the first week the red blood cell count dropped to 1,700,000 in spite of 2 whole blood transfusions. In the following 4 weeks the patient gradually gained 18 pounds in weight, his appetite reappeared, the icterus disappeared completely and the red blood cell count rose to 3,900,000 with normal protein blood chemistry when discharged. At no time during the patient's hospitalization was there hematemesis or melena. Occult blood was noted only in the gastric contents.

Two months following discharge, the patient had had no recurrence of symptoms and there was a further gain in weight to 149 pounds. Complete blood count at this time was reported to be within normal limits.

DISCUSSION

Both patients fall into the age group where gastro-intestinal carcinoma is pre-eminently the diagnostic consideration; and in the event of gastro-intestinal bleeding of insidious nature, as demonstrated in the foregoing cases, many special examinations frequently must be employed before a definite single diagnosis can be established.

Generally most cases of gastritis, with or without bleeding, occur between the ages of 30 to 60 years, the incidence being greater in the male sex.

It is of significance that in both these cases a history of alcoholic ingestion was not a predisposing factor.

Many cases of proved gastritis will have on careful elicitation of the history a more prolonged course than the foregoing histories indicate, especially so if the hypertrophic or atrophic varieties can be demonstrated. A history of shorter nature frequently indicates the superficial variety of gastric involvement.

Excellent discussion of the symptomatology can be found (1) (7) (8). Suffice it to say that symptoms suggestive of true peptic ulcer may be elicited, but more frequently symptoms of an uncomplicated gastritis are those of a general nature involving the upper gastro-intestinal tract with no typical pattern, as illustrated in these cases.

Treatment in both cases was similar, and followed the outline described in Case 1.

Much has been written concerning the relationship between atrophic gastritis and primary pernicious anemia and the fact that patients with pernicious anemia frequently develop polypoid or carcinomatous

change of the gastric mucosa (9) (10) (11) (12). Schindler and Serby (13) are of the opinion that in some cases atrophic gastritis may result from a deficiency of the antianemic factor and occur without associated blood changes. This statement is of interest in a review of Case 2, and a follow-up of this type of patient is most important.

SUMMARY

1. A statement indicating the necessity of being diagnostically conscious of gastritis as a cause of upper gastro-intestinal hemorrhage has been stressed.
2. A brief review of the literature has been given.
3. Two case histories of gastritis with hemorrhage have been presented and briefly discussed.

REFERENCES

1. TUMEN, H. J., and LIEBERTHAL, M. M.: Chronic gastritis; review of its present status. *Internat. Clin.* 2: 263-291, June 1941.
2. BENEDICT, E. B.: Hemorrhage from gastritis—gastroscopic study. *Am. J. Digest, Dis. & Nutrition.* 4: 657-664, Dec. 1937.
3. SCHINDLER, R.: Ein völlig ungefährliches, flexibles Gastroskop. *München, med. Wchnschr.* 79: 1268-1269, Aug. 5, 1932.
4. SCHINDLER, R.; ORTMAYER, M., and RENSHAW, J. F.: Clinical symptoms of chronic gastritis. *Arch. Int. Med.* 60: 143-153, July 1937.
5. BENEDICT, E. B.: Hypertrophic gastritis; gastroscopic and clinical studies. *Gastroenterology* 1: 62-66, Jan. 1943.
6. BENEDICT, E. B.: Hemorrhage from gastritis; report based on pathological, clinical, roentgenological and gastroscopic findings. *Am. J. Roentgenol.* 47: 254-261, Feb. 1942.
7. SCHINDLER, R.: *Gastroscoy.* University of Chicago Press, Chicago, Ill., 1937.
8. BOCKUS, H. L., et al.: *Gastro-enterology.* Volume I. W. B. Saunders Company, Philadelphia, Pa., 1943. pp. 566-567.
9. MINOT, G. R.: Anemia and gastro-intestinal tract; synopsis (Alvarez lecture). *Am. J. Digest. Dist. & Nutrition.* 3: 643-646, Nov. 1936.
10. BROWN, M. R.: Pathology of gastro-intestinal tract in pernicious anemia and subacute combined degeneration of spinal cord; study of 151 autopsies. *New England J. Med.* 210: 473-477, March 1, 1934.
11. JONES, C. M.; BENEDICT, E. B.; and HAMPTON, A. O.: Variations in gastric mucosa in pernicious anemia; gastroscopic, surgical and roentgenologic observations. *Am. J. M. Sc.* 190: 596-610, Nov. 1935.
12. WASHBURN, R. N., and ROZENDAAL, H. M.: Gastric lesions associated with pernicious anemia. *Ann. Int. Med.* 11: 2172-2180, June 1938.
13. SCHINDLER, R., and SERBY, A. M.: Gastroscopic observations in pernicious anemia. *Arch. Int. Med.* 63: 334-355, Feb. 1939.
14. KONJETZNY: Quoted by Schindler (7).
15. KORBSCHE: Quoted by Schindler (7).

ACKNOWLEDGMENT.—The author wishes to acknowledge the aid given by Comdr. John H. Willard (MC) U. S. N. R. for the gastroscopic examinations performed in the reported cases.

GENERAL INFORMATION REGARDING TROPICAL HYGIENE AND LIVING IN THE TROPICS¹

MANY of our foreign stations are in tropical areas and young medical officers who expect to go for a tour of duty in such areas are greatly interested in conditions there and the changes in normal living in a tropical environment. With proper knowledge of tropical hygiene and the cause and prevention of the important endemic diseases of the Tropics, no detriment to the health is to be expected and white men, women, and children can live and enjoy life there as well as in the Temperate Zone. Also, at times, all medical officers are called upon to give advice regarding naval hygiene in the Tropics. For these reasons, the following hints or notes on the subject are printed here. They represent the careful opinion of medical men with long and varied experience in tropical life and were approved by one of the most distinguished writers on tropical diseases.

In order to live in the Tropics and maintain health, the person accustomed to life in a Temperate Zone must make certain adjustments in his habits. Climatic conditions, food, and the customs of the people are all different. There are also certain diseases peculiar to the Tropics which have to be avoided.

Avoid excessive exposure to sun.—Keep the head covered when in the direct sun and in general avoid being out in the sun during the midday. When in a bathing suit gradually expose parts of your body to the sun. The first exposure should be no longer than for 10 minutes. The eyes should be protected by satisfactory dark glasses.

Midday siesta.—A siesta from about 1 to 3 every afternoon should be strictly observed. The room should be darkened, clothing removed, and rest in a reclining position taken. Sleep is not necessary during a siesta and one may read or converse, but it should be a period of rest and relaxation. People coming from a Temperate Zone are often contemptuous of the tropical habit of taking a siesta, but it is an extremely important hygienic measure and should be followed if health and well-being are to be maintained in any lengthy sojourn in the Tropics. It

¹ This article is being published because of suggestions submitted in the questionnaire printed in the November-December issue of the BULLETIN, requesting information of this character for young naval personnel and their families expecting to go to duty at tropical and other overseas stations.

is of particular importance that children observe a long period of rest in the middle of the day, and that they, as well as adults, get plenty of sleep at night. It is desirable in the Tropics to begin work early in the morning and to stop in the middle of the day or early afternoon, when lunch and a siesta may be taken, followed by a period of light exercise before dinner. This has the advantage of placing the working hours and also the hours of outdoor recreation in the cooler part of the day.

Drinking water.—Be sure about the water you drink, used in washing your teeth, and in the preparation of food. Water may transmit typhoid fever, dysentery, and other diseases. Use a reliable bottled water or water certified by the local health authorities and the Navy as being satisfactory. Ice requires similar precautions.

Milk.—Use only properly pasteurized or boiled milk or canned evaporated milk or milk powder. Do not use local milk or local ice cream unless certified as safe by a naval medical officer or the local health officials.

Food.—Food spoils readily in the Tropics. It should be prepared shortly before it is eaten. Never keep prepared food for any considerable interval. Hold over as few dishes as possible. Be particularly suspicious of ground meats, minced ham, fish and other seafoods, eclairs, and custard-filled pastries. Throw away any food that appears suspicious. Use no local fruits or vegetables in the Tropics unless they are peeled or immersed for a short time in boiling water. In spite of the large amount of sunshine, rickets can exist in the Tropics, and children's diets may have to be fortified with cod-liver oil. Except for poultry and fish, the meat used by the average Navy family in the Tropics is imported frozen meat, usually of a very high quality. Most of the locally grown and butchered tropical meat is stringy and tough. Furthermore, it is said to be not as nutritious as meat grown in the Temperate Zone. Recent investigations indicate that its vitamin content is less than northern-grown meats.

Clothing.—White or light-colored clothing of cotton or linen should be worn in the Tropics. Underclothing should be of a light and porous material which will readily absorb perspiration. It must be remembered that, because of the excessive sweating, the skin may be easily chilled. Therefore, in the evening, if exposed to the wind or drafts, a lightweight flannel jacket or coat should be available. A lightweight sweater is a useful accessory to clothing in the Tropics. Suitable rain clothes are also necessary, for during the rainy season they are greatly needed. A lightweight tropical helmet or light straw hat should be worn when exposed to the sun. A panama hat is an ideal headgear in the Tropics for both men and women. For children, one-piece play suits of khaki or light colors, with loosely woven nainsook combination underwear, are excellent. Thin flannel underwear and

thin flannel sleeping suits are desirable for smaller children, particularly during the rainy season or if the weather is unusually changeable. Necessities to a woman's outfit are lightweight cotton and linen wash dresses. White parasols lined with green are excellent accessories and very valuable for a walk in the sun. White socks and stockings and white shoes should be worn as much as possible.

Mosquitoes and disease.—Many important tropical diseases are carried by mosquitoes. The principal ones are malaria, yellow fever, dengue fever, and filariasis. The mosquito can be regarded as a most dangerous insect in the Tropics. Houses should be well screened, and nets should be provided for beds. Mosquitoes frequently breed around the houses and even in them. Any small accumulation of water will permit their development. Water in flower vases, cans, and pitchers should be thrown out daily. A flit gun or similar insecticidal weapon is a useful article around every tropical house. Every effort should be made to avoid being bitten by mosquitoes. The mosquito, which transmits malaria, usually bites between sundown and sunup.

Poisonous fishes.—Some species of fish will cause illness if eaten at certain seasons of the year. Learn which of the fishes in your locality are poisonous and the times of the year when they should not be eaten. Intelligent natives and residents can usually supply this information. Fish most apt to be dangerous are the barracuda and various jackfish.

Vegetable poisons.—Poison ivy of the Temperate Zones is not found in most tropical countries, but various tropical plants are poisonous in a similar way. The foliage of the croton, often used as an ornamental plant in the Tropics; the fruit of the mango tree; the berries, fruit, and leaves of the manchineel tree; and also a number of other tropical plants are poisonous. When touched, these various plants produce serious skin lesions. Their harmful effects may be prevented as in the case of poison ivy by: (a) avoiding contact with them, (b) free use of soap and water immediately after contact with suspicious vegetation.

Scorpions, centipedes, and black widow spiders.—While not usually fatal, the bites of these insects may be painful and cause severe discomfort and illness. Bathrooms are favorite haunts of centipedes, and the scorpion frequently gets in people's shoes and clothing. The habit of shaking one's shoes and clothing before putting them on is a good one to acquire when living in tropical countries.

Hookworm.—Many tropical areas are infested with hookworm. Children should never be allowed to go barefooted, for in this manner hookworm is acquired. The larvae enter the skin from the polluted soil. They may be present in the soil adhering to tuberous vegetables such as potatoes. When working in a garden one should have on good leather gloves.

Intestinal worms.—For the most part these infestations are acquired from polluted soil which finds its way into the mouth by means of food, water, or soiled hands. Strict attention to hygienic measures tend to prevent this. Frequently whole families become infected through a household servant who is a carrier of these worms and contaminates the food.

Bathing.—Because of excessive perspiration, bathing in the Tropics is very important. A daily shower, preferably after recreation or exercise in the afternoon is desirable. Many people like to take a shower in the morning on rising as well.

Skin infections in the Tropics.—One hears a great deal of athlete's foot, tropical foot itch, and other skin infections which are more usual in the Tropics than in the Temperate Zone. Susceptibility to these fungus infections varies much as it does to infection from bacteria. Preventive measures of value are to see that the feet, and indeed the whole body, is carefully dried after bathing. Plain dusting powder or talcum powder should be dusted between the toes, and it is of value to dust in the armpits and about the groin and genitalia, as these are also favorite places for fungus infections to gain a foothold. One of the most distressing conditions in the Tropics, especially in children, is prickly heat. Avoidance of excessive heat, loose cool clothing, bathing, the siesta, the use of dusting powder are all important in the prevention and treatment of this condition. Another skin disease which is often prevalent and particularly serious in infants and young children is an infection of the skin with a germ which produces a blisterlike elevation, and which after the blister ruptures leaves a raw surface. These conditions are infectious, and avoidance of contacts with people having them and measures of cleanliness of skin and clothing are important in their prevention.

Recreation.—Although a siesta during the middle of the day is necessary in the Tropics to preserve health, it is also true that a certain amount of daily exercise and recreation is needed. It should be of a less strenuous character than in a Temperate Zone. However, walking, swimming, horseback riding, tennis, golf, fishing, hunting, all may form a part of the recreational program in the Tropics as well as in cooler climates. One difficulty is that, because of the heat, there is a tendency on the part of people not to take regular exercise. This inclination must be restrained. The only thing is that the exercise must be moderate—more moderate than in a cool climate.

Alcohol.—This must be used sparingly, or better not at all, if health is to be maintained. Physiological effects induced by alcohol seem to be intensified in a tropical climate, and its ill effects, if taken in excess, more pronounced.

General differences between disease conditions in Tropics and elsewhere.—In a general way the acute respiratory diseases, such as colds, pneumonia, tonsillitis, sinusitis, bronchitis, and similar acute respiratory conditions are less frequent and less severe in the tropics than in colder climates. Asthma and hay fever are not as common in the tropical areas. However, it must be remembered that these diseases are far from being absent. Diseases more frequent in the Tropics are gastro-intestinal diseases, such as the various dysenteries, and also diseases carried by insect, such as malaria and yellow fever. Certain skin diseases due to fungus infections are also more common in the Tropics.

Vaccination.—Vaccination against smallpox and inoculation against typhoid and tetanus should be carried out before going to or shortly after arriving at the tropical station. All three of these diseases are prevalent in the tropics, and these protective measures furnish a high degree of immunity against them. In certain localities, other special inoculations and vaccinations may at times be desirable and should be taken if strongly advocated by the local health authorities and naval medical officers at the station.

Acclimatization.—The body adapts itself to any new environment, even one involving considerable changes in climate, air, temperature, water, food, and mode of living. It does not make this adaptation instantly, however. A considerable period of time, several weeks or months perhaps, is required. The period required for this change is known as a period of acclimatization. Minor digestive disturbances due to the change of water and food occur. A person often complains of feeling fatigued on relatively slight exertion, and on first going into the Tropics many people have a tendency to catch a cold. However, if care is taken, the adaptation to the new climate is very successfully made and if common sense is used in restricting the activities and adopting a suitable mode of life, and reasonable precaution taken to avoid the special diseases of the region, life in the Tropics for the American or European is as healthful as anywhere else. Indeed, a sojourn in the Tropics can be a most pleasant experience. During the dry season the climate is delightful. Every day is as someone has expressed it, "Just like the *first* day." It is like a new-minted coin and exactly the same as the day which precedes it and the day which follows. There is less difference in the length of the day than in the Temperate Zone, and there is almost no twilight. Day passes quickly and directly into night without any twilight period. The equability of the climate, its mildness, the profusion of flowers and fruits, the slower pace of life, all of these, if properly appreciated, can make life in the Tropics extremely agreeable as well as healthful.

THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



RESULTS OF QUESTIONNAIRE IN NOVEMBER-DECEMBER ISSUE OF THE U. S. NAVAL MEDICAL BULLETIN

There have now been received 286 replies to the questionnaire submitted to readers of the U. S. NAVAL MEDICAL BULLETIN in the November-December 1947 issue. Readers were asked how often the BULLETIN should be published, and sections usually read. In addition, comments and criticisms were requested and suggestions for additions or other changes.

A careful study has now been made of the replies, which have been analyzed and collated with very interesting results. These will now be briefly recapitulated. The first thing of interest is that although criticism was freely invited, the general tone of the comments was most flattering, both as to professional material and format. Particularly noticeable was the praise of the illustrations, which a number of readers were emphatic in saying were the best they had seen in any medical journal. This expression of the BULLETIN's excellence was not made by one or two but it was typical of the general tone. A few of these comments are quoted:

"An instructive magazine that contains articles of particular use to the naval medical officer."

"A good magazine of excellent readability."

"The BULLETIN is extremely useful as it brings the goodwill and cooperation of the Reserve Corps into the service that sponsors it."

Particularly interesting were the numerous favorable expressions from members of the Naval Reserve who are now engaged in civilian practice. One of these doctors writes: "Incidentally, I believe the U. S. NAVAL MEDICAL BULLETIN to a Reserve medical officer is a factor of very great importance in maintaining mutual contact and interest between the Reserve and the Regular Corps."

Most interesting were the suggestions for changes or additions to the present BULLETIN. Some of these are arranged in the numerical order of demand:

1. Naval medical history page.
2. Question and answer box.
3. Review of medicine and medical science similar to that in the Jan.-Feb. 1947 number.
4. Type of clinical pathological conference (to have a clinical case for diagnosis of the brain-teaser type of case report).
5. Reserve page devoted to Naval Medical Reserve news.
6. Atomic medicine section.
7. New drugs and new uses of old drugs.
8. A short article on tropical diseases seen in some overseas stations and the living and medical conditions in the Tropics. This is of particular interest to young medical officers who will be ordered to foreign stations.

Almost without exception there were objections to a medical and nautical humor column. There were a few requests for this, but there were a large number of most emphatic negatives.

Because of the excellence of so many of the suggestions, one must regret the inability to put all of them into effect. Limitations on both money and personnel make it necessary to publish the BULLETIN bi-monthly and also results in a size limitation of the magazine. The work required to prepare the publication with all the enumerated special features would necessitate an increase in personnel which is unavailable during the present personnel shortage.

Despite these restrictions in both personnel and space, an effort will be made to put into effect some of the suggestions.

First of these will be a naval medical history page. This was the one subject most frequently requested.

Second will be a question box, particularly in regard to the problems of naval medicine.

Third will be a clinical pathological case for diagnosis, of the brain-teaser type. The symptoms, signs, and laboratory reports will be given on one page. A blank space will follow to permit the reader to write out his own diagnosis of the case. On the next page or toward the end of the magazine, or possibly in a subsequent number, the clinical and pathological diagnosis as finally established, will be given. In other words, it will be a kind of "case mystery" handled somewhat like the best-seller murder mystery.

Fourth will be an article describing living conditions and medical care in the tropics or other overseas stations as members of the Medical Department of the Navy will at some time be sent to these areas and often their families will accompany them.

Fifth, some numbers will contain reviews of the most recent advances in one of the medical specialties or medical sciences.

There were very few replies from dental officers but these emphasized the desirability of dental articles. Every effort is made to have at least one dental article or case report in each issue. There is, however, a paucity of good material received in the dental field. It is believed that the Naval Dental School has done much to encourage dental officers to prepare and present dental articles, and more space can be given to this subject if suitable material is submitted.

The editor of the *BULLETIN* is very grateful to the many readers who have made the numerous and excellent suggestions and who have taken the time and trouble to furnish comment that will be useful in future editorial and publication policies.



GRANULOMA INGUINALE AND LYMPHOGRANULOMA VENEREUM

The similarity and multiplicity of names which have been given to these two diseases and, until recently, the obscurity of the etiology have led to considerable confusion in the minds of many as to the distinction between these two conditions. For this reason, the high lights in regard to them are contrasted so that the two entities stand out more distinctly.

GRANULOMA INGUINALE.—This disease is caused by the *Klebsiella granulomatis* (Donovan body). Among its synonyms are granuloma venereum and pudendal ulcer. Its characteristic features are deep purulent ulcerations of the skin of the external genitals. It is particularly prevalent among the dark skinned races of India, Africa, the Pacific Islands, and parts of South America. The treatment was antimony. Intravenous injections of tartar emetic were given and a solution of it was applied locally. More recently the use of zinc peroxide as a local application has been fairly successful. The sulfonamides have also been used. The most recent treatment has been with streptomycin, and reports are particularly favorable.

LYMPHOGRANULOMA VENEREUM.—Other synonyms include tropical bubo, lymphathia and venereum, and Frei's disease. This infection is caused by a virus, and is distinguished by a chronic ulceration in the inguinal and iliac lymph glands, and by stricture of the rectum. Elephantiasis of the penis and scrotum may also occur due to destructive injury and obstruction of the lymphatics. It is the disease in which the Frei test is used. It is most common in the Negro and other

dark skinned groups and is found throughout the whole of India, China, Malaya, West Indies, and South America. Tartar emetic or compounds of antimony have been the usual treatment, and recently the sulfonamides have given evidence of value.



EPIDEMIC DIARRHEA OF THE NEWBORN

This is a problem that has confronted a number of clinics dealing with dependent care. Clifford in the New England Journal of Medicine has recently drawn attention to the recent increases in epidemic diarrhea in infants and relates it to the transfer of childbirth from the home to the hospital. Here the crowding of nurseries and lack of proper personnel and other facilities leads to the spread of the infection.

The fact that the disease is a specific virus is pretty well established. It is equally certain that transmission is by the fecal-oral route and epidemics represent a breakdown in the standard formula preparation and nursery routine.

The prevention of these epidemics should therefore, be directed to the prevention of crowding in nurseries.

The separation of the nursery into small groups of four to eight infants, the prevention of *crowding*, adequate trained personnel, and a *strict observance of formula preparation and nursing technique* are the proper preventive measures. None are easy to provide but all are necessary. The reversal of the trend from home to hospital in the matter of obstetric care is another alternative of doubtful practicality and possibly undesirable, as safer delivery can usually be provided in the hospital with the least number of doctors and nurses. Finally, the most effective preventive measure of all must not be neglected—breast feeding.



WHERE IS THE APPENDIX?

The answer to that question confronts every surgeon when he puts his finger through a McBurney's incision. It is still a problem if he enlarges the wound to look into the abdomen for the appendix can be found almost anywhere in the abdomen or pelvis, and even in the thoracic cavity through a diaphragmatic hernia or in the scrotum in an inguinal hernia. It may be retrocecal, the cecum may be rotated, and on the left side, and all of this affects the place where

the appendix will be found. There is one certain rule to follow however, and this is that the appendix does originate at the junction of the large and small intestines. The first thing the young surgeon must learn is how to locate the cecum and its longitudinal bands. Every search for the appendix if it does not immediately present itself on opening the abdomen must begin at the ileocecal junction. Its anatomy *must be familiar to the eye and the fingers*. Starting from that point the appendix can then be followed and dissected free. If the ileum is carried up behind the cecum, it must be followed, and the point of junction with the cecum found, for there also will be the base of the appendix.

All other methods of location may not be useful but this one is certain and unchanging. Recognition of the cecum, the ileocecal bands, the junction of the large and small bowel are sure ways to find the base of the appendix and from there no matter how long or aberrant, it may be followed to its tip and isolated. It is Lesson No. 1 for the young surgeon.



CONSERVATIVE TREATMENT OF PLACENTIA PREVIA

It is now more than 40 years since De Lee advocated the conservative treatment of puerperal sepsis that led to a distinct lessening in maternal mortality from this cause. Now we have a similar development in another important obstetric difficulty, placenta previa. In the last few years a number of obstetricians have pointed out that, without interference, fatal hemorrhage in cases of placenta previa will not occur, particularly when the fetus is not yet viable. More than 20 years ago, it was demonstrated by Watson and Miller in the *Edinburgh Medical Journal* that simple rupture of the membrane was the best and safest course to follow in most instances. Johnson in the *American Journal of Obstetrics and Gynecology* in September 1945 and Macafee in the *British Journal of Obstetrics and Gynecology* for August of the same year gave further testimony in favor of conservatism. Recent statistical comparisons by Daichman and Pomerance, published in the *American Journal of Obstetrics* in June 1947 showed that the fetal mortality was nearly twice, and the maternal mortality nine times greater, with the hydrostatic bag than by rupture of the membranes or cesarian section. It must be admitted that the patients were in hospitals where radical intervention could be quickly instituted; that blood transfusions were extensively used; and that

cesarean section is really a radical procedure. Still the whole idea of conservatism in this condition is of undoubted value in many cases.



THE MEDICAL HISTORY OF THE NAVY—WORLD WAR II

From time to time in the newspapers and service journals there are references to official histories of World War II. A number of officers have also been asked to contribute monographs on historical subjects and references have been made to an official war history in circular letters or other official correspondence and conversations. As a result, considerable interest has been aroused in the subject with a corresponding lack of information about the general plans for a war history, progress in preparing it, the purpose of it, character, time of completion, and a number of other features. For this reason, a short account of the situation as to official war histories will be of interest.

Official war histories are not new. As far back as Waterloo, the dispatches and correspondence of Wellington were published under governmental auspices. Elaborate official histories of our Civil War were printed and sets of them are now most valuable and highly prized. An official medical history of the Navy from 1861–65 was prepared but never printed though two or three successive Surgeons General asked for funds. The manuscript cannot now be found and is presumed lost. Official histories of the Franco-Prussian War, the Spanish-American War, the Boer War, World War I have been prepared by participants in those conflicts. There is thus plenty of precedent for an official narrative of World War II.

On March 4, 1942, President Roosevelt issued a directive providing for a history of the war then in progress. As a part of the project, there was to be an official medical history of World War to include not only the armed services but civilian groups, such as air raid organizations and other civilian agencies. At first, it was attempted to have a combined history but later the various groups arranged to prepare histories involving their own organizations.

An Office of Naval History has been created in the Navy Department to be in charge of the official history of naval operations and naval administration during World War II. As part of the general program, official histories are being prepared by various bureaus and the Marine Corps.

A naval medical history of World War II has been planned and a Medical History Branch has been set up in the Division of Publications in the Bureau of Medicine and Surgery. This Branch of Medical His-

tory and Medical Museum (to give its official title) is engaged in the preparation of the official naval medical history of World War II, a number of other naval medical historical projects, and the preservation of suitable museum material. The authors for about 85 monographs dealing with professional fields have been selected and about 15 monographs have been completed.

It is surprising how many questions regarding the medical history of the Navy are received and how many demands there are for it from individuals, educational institutions, libraries, Government departments, and by the Medical Department itself. There are wonderful opportunities for work in the naval medical historical fields which would have far reaching results in planning, indoctrination, recruiting, and in promoting public relations of the best character.



THE TREATMENT OF YELLOW FEVER

There has been a vast amount of work done on the etiology, epidemiology, and prevention of yellow fever with results as remarkable and successful as are to be found in the history of any disease. On the other hand, little has been accomplished in the clinical treatment. Anything promising in this field is therefore news.

One of the characteristics pathological findings is acute parenchymatous degeneration of the liver, and protective measures for that organ are indicated. The effects of chloroform on the liver cell is similar to that of yellow fever and in 1942, Bay, Banfi, and Tanvri used vitamin K as a protective measure. It is water-soluble and may be given intravenously. Hoffman now advocates its use early in the treatment of all cases of yellow fever or even suspected cases as the damage is soon done and early beginning of the treatment is important.



THE WELLCOME PRIZE IN 1947

The Sir Henry Wellcome Prize in Military Medicine, awarded by the Association of Military Surgeons of the United States, was received by Maj. Marshall R. Urist, M. C., A. U. S., who is on duty at the University of Chicago, for his essay, "The Management of Battle Incurred Compound Fractures in the Region of the Hip Joint."

The award was made at the recent annual meeting of the Association of Military Surgeons in Boston, Mass. The recipient was given the certificate, a check for \$500, and a facsimile of the gold medal. Of interest to recipients of the medal from 1943 to the present time is the fact that the dies from which the medals were struck were destroyed when the British Mint in London was bombed during the war and since that date only replicas of the medal have been issued. It is intended, of course, that as soon as new dies are made and the gold is available, gold medals will be struck and issued to past recipients.



EXAMINATIONS BY THE AMERICAN BOARD OF OPHTHALMOLOGY

PRACTICAL EXAMINATIONS—1948

Baltimore, May 20-25th

Chicago, October 6-9th

Written qualifying tests will be held annually, probably in January of each year. Applicants for the January 1949 written qualifying test must be filed with the secretary before July 1, 1948.

A supplement of diplomates from January 1947 to January 1948 will be sent gratis to all purchasers of the Board's directory. This supplement is arranged alphabetically and geographically. No biographical material is included.

Diplomates are urged to keep the Board office informed of all changes of address, so that the files can be kept up to date.



MEDICAL AND DENTAL OFFICERS

*Whose Deaths Have Been Reported Since
the Last Issue of the Bulletin*

GREEN, DOVE WALTER, Captain (MC) U.S.N.R. (Retired, Inactive). Died 16 January 1948 at U. S. Naval Hospital, Naval Base, Charleston, S. C.

JANDER, JOSEPH ERNEST, Lieutenant Commander (DC) U.S.N.R. Died 5 January 1948, at Brooklyn, N. Y.

ROBERTSON, CARL JAMES, Captain (MC) U.S.N. (Retired, Active). Died 16 February 1948 at U. S. Naval Hospital, San Diego, Calif.

SHAW, HARRY, Lieutenant Commander (MC) U.S.N. (Retired, Inactive). Died 12 October 1947 at Kansas City, Mo.

CLINICAL NOTES



HODGKIN'S DISEASE INVOLVING THE EPICARDIUM

Report of a Case

JAMES J. McCOY, JR.¹

Lieutenant Commander (MC) U. S. N.

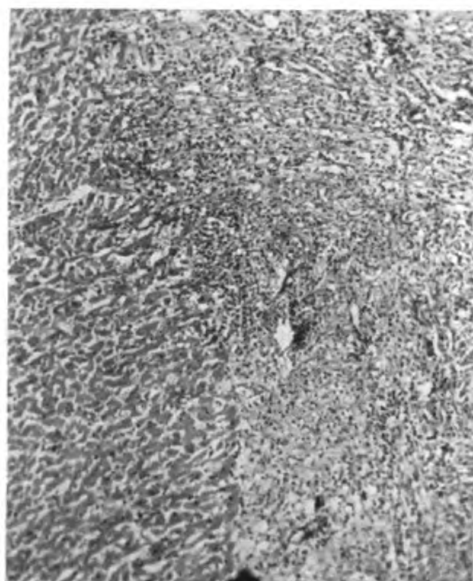
Hodgkin's disease primarily involves the lymph nodes, liver, spleen, and bone marrow in most instances (1). It may reach certain other organs by direct extension or by retrograde coursing through the lymphatics, but involvement of the heart is considered to be rare (2).

The earliest record of the lesions of Hodgkin's disease appearing in the heart was made by Murchison (3) in 1869. Most reviewers of such literature agree that the diagnosis established in his paper was valid.

Barone, in 1930, uncovered a mediastinal tumor in a 28-year-old man in whom the autopsy revealed that the mass had extended into the right atrium, destroying some of the myocardium and projecting into the lumen. This is well evidenced by photomicrographs of the lesion (4). In 1939 Harrell (5) reported Hodgkin's lesions in the pericardium, epicardium, and myocardium of a 35-year-old male patient who had a pericardial friction rub clinically. He made an excellent review of the literature and found eight cases. A thorough explanation of retrograde involvement of the epicardial lymphatics is included in his article. Ritvo (6), whose patient was a 49-year-old woman who had been known to have had the disease for 17 years, described the necropsy finding of a small tumor mass of Hodgkin's tissue in the right auricle. Catsaras and Patsouri (7) stated their case in 1941 as that of a 33-year-old woman whose heart at autopsy was found to have multiple polypoid Hodgkin's tumors hanging freely in the right and left ventricles. They reviewed the European literature and discovered 10 additional cases.

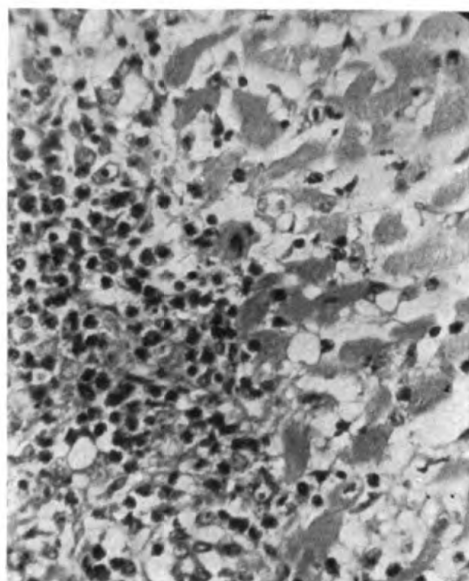
In the following year Garvin (8) recounted the case of a 37-year-old woman who had had the disease for over 10 years. During this long period there had been clinical evidence of auricular fibrillation and its consequent electrocardiographic abnormalities accompanied by

¹ Resigned 15 May 1947.



—Courtesy Commander W. C. Andrews (MC) USN

Figure 1.—Low power view of the lesion in the epicardium. The granulomatous character is evident and the rich cellular element is formed chiefly by eosinophils and small lymphocytes. The close relation to the myocardium may be noted here.



—Courtesy Commander W. C. Andrews (MC) USN

Figure 2.—High power photomicrograph of the lesion showing early degenerative changes in the myocardial fibers into which there is some encroachment by the granulomatous Hodgkin's tissue.

cardiac enlargement. Roentgen therapy produced a decrease in the size of the cardiac shadow and subsequent clinical improvement but the patient gradually ran a declining course. The pathological findings were those of a mediastinal Hodgkin's mass, part of which had protruded through the right atrial wall to form a singular polypoid tumor suspended in the lumen. Ayerza and Cernich (9) related the case of a 38-year-old man who, in 1943, entered their clinic because of dyspnea, tachycardia, and ankle edema. The clinical finding of pericarditis with effusion led to a paracentesis. The fluid so obtained was found to contain 80 percent eosinophils and many atypical cells which Negrin thought to resemble those of the Sternberg variety. A clinical diagnosis of Hodgkin's disease was thus made and later established by a post-mortem examination which disclosed a hemorrhagic Hodgkin's pericarditis besides extensive involvement of the mesenteric lymph nodes and a lesion in the right kidney.

CASE REPORT

The patient, A. C., a 20-year-old white Marine, was admitted to a U. S. Naval Hospital, on 14 March 1944 with the diagnosis of Hodgkin's disease having been established previously at another naval medical facility through biopsy of an enlarged cervical lymph node. Painless swelling of cervical nodes had been the original complaint.

At this activity treatment consisted of roentgen therapy to the cervical, axillary, and right inguinal lymph nodes and an anterior mediastinal mass. Some improvement occurred under this regimen and the patient was discharged to local duty under treatment and observation in December 1944.

He was readmitted, however, in March 1945 complaining of easy fatigue, weight loss, and right chest pain. There was dyspnea on exertion and the right inguinal nodes had enlarged considerably. X-ray revealed marked infiltrative lesions in the right pulmonary fields. Despite intensive roentgen therapy the patient slowly declined. There was increasing frequency and severity of the dyspnea and the left cervical nodes increased in size. Swelling of the left arm with engorgement of the veins of this extremity and clubbing of the fingers of the left hand became pronounced. Splenomegaly was so marked that the patient was unable to rest on his left side. He expired 27 August 1945.

Post-mortem examination—General.—The veins of the neck, arms, and upper thorax were prominently distended. The cervical, axillary, and inguinal nodes were moderately enlarged. The thorax: The superior, anterior, middle, and posterior mediastinal nodes were greatly enlarged and had fused into a mass which constricted the great veins and encompassed the trachea, bronchi and esophagus. There were bilateral pleural effusions and the visceral pleurae were sprinkled with small yellow-white nodules. The lungs contained showers of similar lesions. The heart was not enlarged but the pericardial sac contained 250 cc. of clear yellow-green fluid. In the anterior epicardium there was a distinctive involvement of the epicardial lymphatics which stood out sharply defined as firm, raised, yellowish strings, ascending in converging fashion along the course of the coronary vessels in the anterior longitudinal sulcus. The myocardium did not seem to be involved. The abdomen: The superior gastric, hepatic, pancreatico-lenal, adrenal, perirenal, mesenteric, and omental lymph nodes were enlarged to varying degrees. Small yellow nodules were widely disseminated throughout the spleen which weighed 210 grams. There were no lesions found in the liver.

Histopathology.—The general picture was that of Hodgkin's granuloma (10). The lesions in the epicardium showed a granulomatous trend with a rich amount of eosinophils, some small lymphocytes and a sparse number of Sternberg-Reed cells. In some areas there was encroachment of the Hodgkin's tissue upon the more superficial myocardial fibers producing early degenerative changes in the latter.

SUMMARY

A review of the recent literature on the involvement of the heart by the lesions of Hodgkin's disease is presented and a case is reported because it is of comparatively rare occurrence.

REFERENCES

1. BOYD, W.: A Textbook of Pathology. 4th edition. Lea & Febiger, Philadelphia, Pa., 1943.
2. STOUT, A. P.: Human Cancer. Lea & Febiger, Philadelphia, Pa., 1932.
3. MURCHISON, C.: Case of a new morbid growth composed of muscular tissue. in the intestine, liver, kidneys, lymphatic glands, heart and other organs. Tr. Path. Soc. London. 20: 192-196, 1869.
4. BARONE, V. G.: Sopra un caso di linfogranulomatosi maligna cervico-mediastinica, con infiltrazione secondaria del cuore e del pulmone. Riforma Med. 46: 1949-1952, Dec. 8, 1930.

5. HARRELL, G. T. : Hodgkin's disease with invasion of the pericardium and gall-bladder, review of literature and report of case with autopsy. *Arch. Path.* 28: 58-64, July 1939.
6. RITVO, M. : Hodgkin's disease; report of case with unusual longevity and invasion of heart and pericardium. *New England J. Med.* 223: 891-895, Nov. 28, 1940.
7. CATSARAS, J. and PATSOURI, E. : Über eine blastomatös wachsende Form von Herz- und Leberlymphogranulomatose. *Virchows Arch. f. path. Anat.* 307: 297-302, 1941.
8. GARVIN, C. F. : Hodgkin's disease of heart and pericardium. *J. A. M. A.* 117: 1876-1877, Nov. 29, 1941.
9. AYERZA, L. and CERNICH, R. : Granuloma maligno primitivo del pericardio (Caso princeps). *Rev. Assoc. méd. argent.* 57: 981-986, Nov. 30, 1943.
10. JACKSON, H., JR., and PARKER, F., JR. : Hodgkin's disease; II pathology. *New England J. Med.* 231: 35-44, July 13, 1944.



METASTATIC TUMOR IN THE HEART

Report of a Case

WINSTON BRAUN

Lieutenant (MC) U. S. N. R.

and

GEORGE TOWLE HOFFMANN

Lieutenant (MC) U. S. N. R.

The following case is reported because of some unique pathological features which have not been previously described.

CLINICAL ABSTRACT

L. E. W., a 57-year-old white male, was admitted to the hospital complaining of "swollen stomach."

Five weeks prior to admission it was noticed that the abdomen was increasing rapidly in size and that the ankles had become swollen. He was admitted to a charity hospital 3 weeks later. There it was pointed out that the sclerae was icteric and that the abdomen contained fluid. Abdominal paracentesis was performed twice.

His appetite was good, he had not noticed any intolerance to fatty foods, and there was no nausea or vomiting. The stools were soft, occasionally watery, of a light clay color, and on two or three occasions blood streaking was observed. This last sign was attributed to hemorrhoids. Some cramping of indefinite character was noted in the lower abdomen at stool.

Systemic review revealed that he had had a "heart attack" with unconsciousness 7 years ago, followed by occasional precordial pain which did not radiate, dyspnea, and edema of feet and ankles. He had been on digitalis for the past 8 years.

Examination revealed an elderly, chronically ill man. The skin and sclerae were icteric. The head and neck, including eyes, ears, nose and throat were essentially negative. The heart was enlarged downward and to the left with the apex in the anterior axillary line. The heart sounds were of poor quality and there was a soft, blowing systolic murmur heard only at the apex.

The abdomen was protuberant and the liver edge was palpated three finger breadths below the costal margin. The border of the liver felt nodular. The splenic tip could be felt on deep palpation. The prostate was firm and moderately enlarged.

The feet and ankles showed two plus edema.

Laboratory test revealed the following: red blood count 4,000,000 with 11 grams of hemoglobin; white blood count 5,600 with normal differential; urine positive for bile; icterus index 27 units; van den Bergh direct delayed reaction with an indirect of 1.7 mg. percent. The blood Kahn was negative. A cephalin flocculation test done on the twentieth hospital day was three plus in 24 hours.

Abdominal paracentesis was performed on the sixth and again on the seventeenth hospital days, several thousand cubic centimeters being removed on each occasion. The specific gravity was 1.012, the cell count 5,400 with 94 percent lymphocytes. In the last specimen several large, round cells, one of which showed a mitotic figure were seen.

Roentgen studies of the gastro-intestinal tract were inconclusive because of the ascites.

A well-healed primary tuberculous process was visualized in the right lung. The dimensions of the heart shadow were at the upper limit of normal.

An electrocardiograph showed left axis deviation, diphasic T₁ and inverted T₂, which was interpreted as evidence of myocardial damage.

The hospital course was uneventful until the twenty-seventh day. After a moderate breakfast he suddenly became dyspneic, complained of blindness, and expired in a few minutes.

An autopsy was performed 24 hours after death.

The peritoneal cavity contained 7,100 cc. of bloody fluid. A few small clots were found in the right side of the pelvis.

The liver weighed 2,650 grams. The entire surface was studded with soft, green nodules which varied in size from a few millimeters to 5 centimeters in diameter. Many of the smaller nodules had coalesced to firm, large masses. Section of the larger nodules showed soft, green, velvety tissue at the periphery with a core of solid, lobulated masses of white, homogenous tissue. Section through the entire organ showed moderate fibrosis and many small, soft, green masses throughout the parenchyma of all lobes.

The portal vein was plugged with soft, friable, stringy, green material. The vena cava and hepatic vein were not remarkable.

The lower esophagus and fundus of the stomach showed a few varicosities the largest about 3 millimeters in diameter.

The spleen weighed 475 grams. On section the pulp was very soft, almost liquid in consistency, and dark red in color.

The heart weighed 300 grams. The pericardium was not remarkable. There was a firm, round nodule, 4 centimeters in diameter, in the wall of the right ventricle about 2 centimeters to the right of the anterior descending branch of the left coronary artery, and 3 centimeters below the ring of the pulmonary valve. On section this showed a thin capsule of myocardium surrounding a soft, friable, greenish-yellow nodule, which had apparently implanted on the endocardial surface and infiltrated into the myocardium. Additional sections through the ventricular wall showed that this tissue had infiltrated through the myocardium

toward the apex and was roughly in the shape of a cone 4 centimeters in diameter at the base and 6 centimeters in length with its apex at the apex of the heart. It was entirely within the muscle except for a point at the base where two small cauliflowerlike masses extended into the ventricular cavity at a point 10 millimeters below the lower edge of the cusps of the pulmonary valve. The free tip of one of these protruding masses could be lifted up to a point about 3 millimeters below the valve ring.

The left coronary artery showed moderate arteriosclerotic changes in the anterior descending branch.

The lungs did not show any evidence of metastatic tumor.

Microscopic examination of sections from the liver confirmed the diagnosis of primary carcinoma of the liver with tumor thrombosis of the portal vein.

Section from the heart presented the unusual picture of well differentiated, bile-producing, liver cells infiltrating through myocardium.

Many excellent reviews on primary carcinoma of the liver can be found in the literature on the subject. Gregory (1) found reports of 11 cases of tumor thrombosis of the inferior vena cava and/or the right auricle of the heart due to primary carcinoma of the liver and reported one additional case with a tumor thrombus filling the right auricle. He points out that rapidly increasing edema of the lower extremities and genitalia and ascites, in the presence of an enlarged liver (without cardiac disease) should suggest tumor thrombosis of the inferior vena cava or right auricle since edema and ascites in cirrhosis are rarely seen when the liver is enlarged.

Wilbur, Wood, and Willett (2) report one case of tumor thrombosis of the vena cava and one case of tumor thrombosis of the hepatic vein and vena cava with tumor cells enmeshed in a thrombus attached to the tricuspid valve.

We have been unable to find any reports of ventricular metastases or reports of actual invasion of the myocardium by tumor tissue.

There was no evidence that the tumor implantation occurred at the site of an old infarct, but the coronary branch near the site of the implantation was arteriosclerotic, without obliteration of the lumen.

It was felt that the tumor tissue protruding into the right ventricle could have acted as a ball valve in the pulmonary ring, resulting in sudden death.

REFERENCES

1. GREGORY, R.: Primary carcinoma of liver; tumor thrombosis of inferior vena cava and right auricle. *Arch. Int. Med.* 64: 566-578, Sept. 1939.
2. WILBUR, D. L.; WOOD, D. A.; and WILLETT, F. M.: Primary carcinoma of liver. *Ann. Int. Med.* 20: 453-485, Mar. 1944.

FIXATION OF MANDIBULAR FRACTURES

With Report of Three Cases¹

WALTER W. CROWE
Commander (DC) U. S. N.

During the past 3 years, of 382 fractures treated at the dental department of the San Diego Naval Hospital, 349 were mandibular fractures and 33 were fractures of the maxillae.

In the early treatment of mandibular fractures it is of the utmost importance to know that there is an adequate airway, especially if the patient is comatose. Occasionally it may become necessary to hold the tongue forward in order to relieve a pharyngeal obstruction. This may be accomplished by placing a silk suture through the anterior part of the tongue in the midline, for traction.

Hemorrhage should be arrested promptly and the patient's head lowered or held forward in order that blood may drain out of the mouth and not be inhaled or swallowed. Blood clots should be removed from the mouth to prevent a pharyngeal or tracheal obstruction. The mouth should be very carefully examined so that loose or fractured teeth may be prevented from falling into the trachea. All loose prosthetic dental appliances should be removed.

Fibrin foam with thrombin, a product developed by the fractionation of human blood plasma, has been found useful as a hemostatic agent and may be used in conjunction with chemotherapeutic agents (1).

Shock should always be considered and should be treated immediately if it occurs.

To temporarily support mandibular fractures until reduction and immobilization can be accomplished, we have used the Barton bandage. On many occasions, however, a sailor's hat with the brim partially removed and a piece



Figure 1.—Sailor's white hat with brim partially removed and rubber dam placed under the chin. This affords a very quick and simple means of temporary immobilization

¹ From the dental department, U. S. Naval Hospital, San Diego, Calif.

of rubber dam placed under the chin has been used very successfully. This simple appliance holds the teeth and fragments of the lower jaw in position against the upper teeth, and aids materially in the relief of pain (fig. 1).

A complete clinical examination should always be made before the reduction and immobilization of a fracture. Plaster study models are often helpful in planning treatment for complicated jaw injuries, and intra-oral and extra-oral roentgenograms are always advisable.

Teeth in the line of fracture as a general rule should be removed in order to prevent infection, abscess formation, and osteomyelitis. The only exception we have made to this rule is where the tooth becomes necessary for the fixation of a posterior bony fragment. In such cases an adequate drain is placed.

The chemotherapeutic agents used as an aid in the treatment of mandibular fractures have been the sulfonamides and penicillin. The sulfonamides are quite satisfactory, but, due to their toxic effects, they are still somewhat undesirable. Penicillin has been found to be an almost ideal agent for most clinical purposes because of its relative low toxicity. These agents, however, must be considered as a supplementary form of treatment since infection does not subside unless there is adequate surgical drainage and proper removal of infected teeth, foreign bodies, and sequestra (2).

In the preparation of the patient for the reduction and immobilization of a compound or comminuted fracture, adequate premedication should be given. In regard to anesthesia, local and regional anesthesia have been used very successfully in the greater percentage of our cases. Occasionally, however, a general anesthetic agent has become a necessity.

As a rule, the simplest mechanism which will achieve the desired result has proved most successful in our hands. Whenever possible, an intraoral type of fixation has been used. The methods of wiring most often employed in the treatment of mandibular fractures have been:

1. Continuous loop wiring with intermaxillary elastics.
2. Single loop (eyelet) with intermaxillary wiring.
3. Arch bars with intermaxillary elastics or intermaxillary wiring.

In edentulous mandibular fractures, circumferential wiring of the mandible is done, using the patient's denture as a splint to hold the fragments in proper position.

Many fractures seen in the service are compounded, with marked malalignment and deformity. Continuous loop wiring with intermaxillary elastic traction has been found very successful in the reduction and fixation of these cases. This type of fixation is probably the most universally used and abused type of treatment for fractures. Elastic traction effects reduction, after which its only purpose is fixation.

Strong rubber ligatures are necessary in order that the patient may not, by involuntary muscular action, produce some movement. Any motion, however slight, in the early stages of repair will cause injury to the young cells and vessels comprising the granulation tissues, and so will delay repair. Many cases of fibrous union can be traced to faulty early immobilization. A slight movement is favorable to union and callus formation only in the terminal stages of treatment.

Acrylic dental splints are very useful when, due to loss of teeth or bone, it becomes necessary to preserve the dental arch. Also in certain cases of nonunion, where stabilization is deemed necessary and immobilization is not desired, an acrylic splint has been wired to the lingual surfaces of the remaining lower teeth (fig. 2). This appliance gives adequate stabilization in partly healed mandibular fractures, and can be worn until such time as firm union has developed.

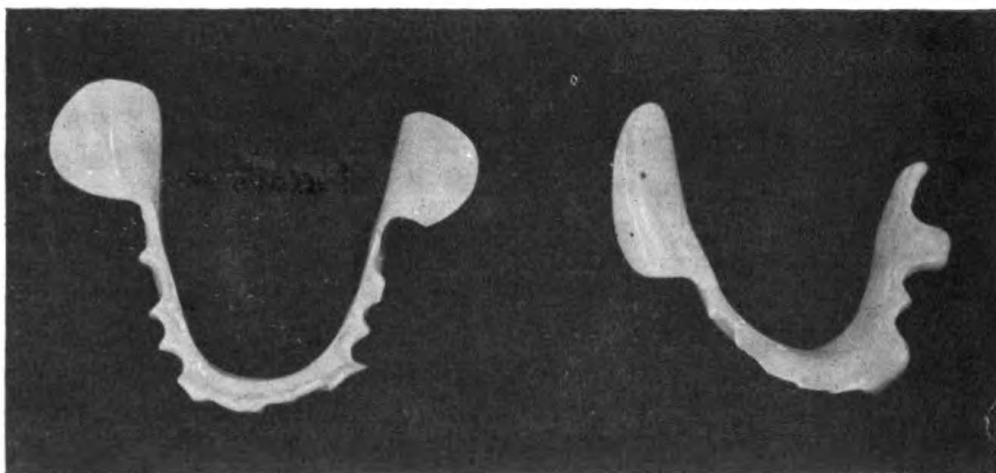


Figure 2.—Acrylic splints used in stabilizing fractures of the mandible.

The distinct advantage of this method of treatment is that it permits the mastication of semisolid food, and good oral hygiene can be maintained throughout the period of treatment.

Intermaxillary wiring is an efficient and relatively simple method of treating mandibular fractures which still holds an eminent place in jaw stabilization. If general anesthesia is to be used in conjunction with intermaxillary wiring, the tie wires should not be placed until the danger of nausea has passed. In the transportation of these patients by sea or air, every precaution must be taken in order that these wires may be cut or removed immediately should the necessity arise.

Arch bars, used in conjunction with intermaxillary elastics or intermaxillary wiring, provide an excellent method in the treatment of many types of fracture. These bars are strong enough to withstand considerable traction and are found very useful with strong intermax-

illary elastics in the reduction of impacted and partially healed fractures which have not been properly reduced. To stabilize an arch bar properly, it is usually advisable to ligate every tooth in the arch from the second molar forward.

Occasionally it has been found necessary to use an external type of fixation such as the Roger Anderson skeletal fixation splint and, in a few cases, an open operation with direct bone wiring has been done. Ivy and Curtis (3) state: "Briefly put, the only indication for use of skeletal fixation in the mandible is the control of fragments where the teeth are absent or do not afford adequate attachment for intra-oral appliances. It should not replace the regular methods of intra-oral fixation when teeth are available."

Intra-oral and extra-oral interosseus wiring is indicated only when it is impossible to maintain the fragments in correct position by other accepted methods of treatment. While this type of treatment does insure immediate reduction and fixation, it should be supplemented by dental fixation if teeth are available, since it alone does not give satisfactory support.

Following reduction and immobilization of a mandibular fracture, regardless of the method used, the patient is given sedation to control postoperative pain and is placed on a high-calorie, high-vitamin liquid diet. He is seen daily, and the importance of proper oral hygiene is stressed. A mandibular fracture has been treated successfully only when normal occlusion of the teeth has been reestablished, the jaw has healed solidly in good position, and food can be masticated in a satisfactory manner.

CASE REPORTS

CASE 1

A 45-year-old white male gave a history of having been in an automobile accident on 6 May 1946.

Examination.—General physical examination at time of injury revealed a well-developed, well-nourished white male with a long deep laceration under the chin. The lower right lateral incisor tooth had been evulsed, and the remaining lower incisor teeth were very movable. There were cuts and bruises of the right knee and right wrist.

Roentgenographic examination at time of injury revealed a compound, comminuted fracture of the mandible in the symphysis area.

Bleeding from the laceration under the chin had been controlled and the wound closed. The patient was placed on penicillin and sulfonamide therapy. Temporary immobilization was obtained by a first-aid chin support.

Operation.—On 8 May 1946 under local anesthesia, the remaining lower anterior incisor teeth were removed. Intra-oral fracture appliances were placed, using intermaxillary elastics to immobilize the mandible.

On 4 June 1946 the intermaxillary elastics and fracture appliances were removed. There was a drooping of the right lower lip due to paresthesia. The occlusion of the teeth was normal, and there was clinical evidence of good union of the fragments. Dental prosthesis was recommended after further calcifica-



Figure 3.—Plaster casts of a compound comminuted fracture of the mandible in the symphysis area, with a collapse of the left mandibular segment, due to the anterior fiber muscular pull of the mylohyoid muscle. This has resulted in a unilateral malocclusion, with the left mandibular teeth internal to their normal vertical plane of occlusion.

At this time all remaining lower teeth were tested for vitality, and all responded favorably. Clinical examination also revealed good bony union of the mandible in the symphysis area.

A partial lower denture was placed 1 November 1946 restoring completely masticatory function as well as esthetics (fig. 6).

CASE 2

A 24-year-old white male reported to the dental clinic with a history of having been in a fight. He had received multiple bruises and lacerations, and complained of a broken jaw. The lower right second molar had been fractured and had been removed except for a portion of the mesial root.

Examination.—General physical examination revealed a well-developed young white male with a jaw that was swollen and tender. Both

tion had taken place. Patient reported in at this activity for further treatment 3 September 1946.

Examination.—Oral clinical examination revealed a narrowing deformity of the lower left jaw due to the traction of the mylohyoid muscle. There was an extreme unilateral malocclusion, with marked inability of the patient to masticate food properly (fig. 3).

The patient complained of a feeling of numbness in the right lower lip, with a sensation of constriction in the lower anterior area of the mandible. The chief complaint, however, was inability to masticate food properly.

Treatment and course.—Study models were made, and on 9 September 1946 a lingual acrylic splint, into which had been placed an orthodontic jackscrew (figs. 4 and 5), was securely attached to the lower bicuspid and molar teeth. This appliance was used in forcing outward very slowly the collapsed mandibular segment, until proper reduction and occlusion were attained.

The splint was temporarily removed while impressions were taken for the construction of a partial lower denture.



Figure 4.—Mandibular acrylic splint with orthodontia jackscrew used in forcing fracture apart.

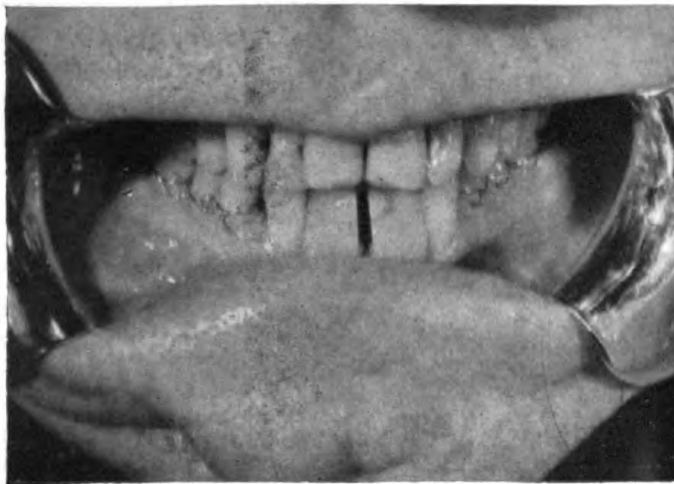


Figure 5.—*Acrylic splint in place, securely attached to the lower bicuspid and molar teeth.*

eyes were blackened, with hemorrhagic right conjunctiva and sclera.

Oral examination disclosed partly edentulous jaws. There was a marked inability to masticate food properly. The jaws could not be opened wide because of pain. Intra-orally, the right posterior fragment appeared to be considerably elevated and to be riding up against the upper molar tooth. The physical examination was essentially negative otherwise.

Roentgenographic examination revealed a compound fracture of the mandible through the socket of the remaining lower molar tooth, with an upward displacement of the posterior fragment (fig. 7). There was no evidence of a fracture of the facial bones or zygoma.

Preoperative treatment.—The patient was placed on a high-vitamin, high-calorie soft and liquid diet.

Temporarily the fracture was immobilized by applying continuous loop wiring with intermaxillary elastic traction. An attempt was made to reduce and hold the posterior fragment in proper position by an intra-oral prosthetic appliance.

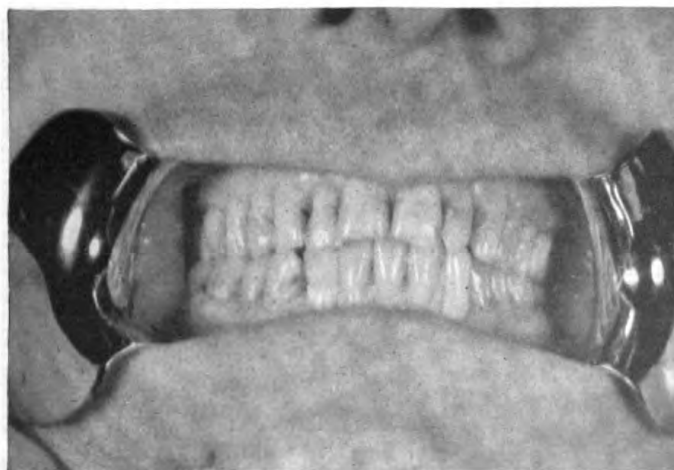


Figure 6.—*Photograph showing reestablishment of normal occlusion, with partial lower denture in place, replacing missing lower anterior teeth.*

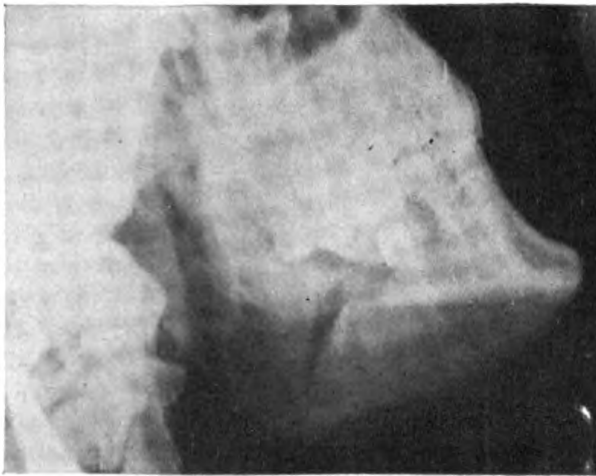


Figure 7.—*Lateral roentgenogram showing compound fracture of mandible in second molar area, with upward displacement of posterior fragment. Contact of ramus with maxillary tooth can be seen. Mesial root of lower molar remaining in line of fracture.*

was placed beneath the medial surface of the mandible to protect the underlying structures. Holes were then drilled in the anterior and posterior fragments, approximately 1 centimeter above the inferior border of the mandible and about 1 centimeter from the fracture line.

Stainless steel wire, 24-gage, double, was passed through the holes in the two fragments. The posterior fragment was held down in proper position while the wires were tightened. The fracture was now reduced (fig. 8). Next, the periosteum and subcutaneous tissues were closed with catgut, and the skin incision was closed with interrupted dermal sutures. A sterile dressing was placed over the area of incision. The throat was packed, and the mesial root of the lower molar remaining in the line of fracture was removed.

Intermaxillary elastics were replaced to insure proper immobilization. These were removed on the third postoperative day and replaced by 26-gage stainless steel wire.

Postoperative course.—

There was a moderate amount of swelling present following the operation with a slight elevation of temperature. The patient was given penicillin, 25,000 units intramuscularly every 3 hours, for a period of 4 days. An intravenous infusion of 1,500 cc. of 5 percent dextrose in saline was given following the operation.

Since this was not successful, an open reduction was done under intratracheal gas-oxygen-ether anesthesia.

Operation.—The draping of the patient and the preparation of the area for operation were in the usual manner. A skin incision was made parallel to and below the inferior border of the mandible. The skin and superficial fascia were reflected with retraction of the underlying tissues. Small bleeders were clamped off with hemostatic forceps. The external maxillary artery was clamped and divided, and its ends were ligated. The periosteum was incised over the fracture area and completely retracted. A broad, flat elevator

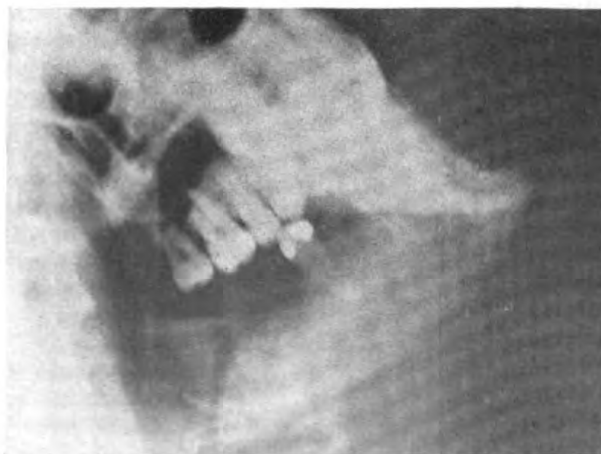


Figure 8.—*Roentgenographic view following open operation for direct bone wiring. Fragments are held in good position. Mesial root of lower molar tooth has been removed.*

On the fourth postoperative day the dermal sutures used in closing the skin incision were removed. Roentgenographic examination at this time showed the fragments to be in a satisfactory position.

The patient made an uneventful recovery. The bone fragments had united, occlusion and function were good, and no deformity was evident. A prosthetic restoration is to be placed at a later date.

CASE 3

A man, aged 23, was admitted to the hospital complaining of a fractured jaw as the result of a fight.

Examination.—General physical examination revealed a well-developed young white male with no abnormalities except a compound fracture of the mandible. There was marked deformity, with lingual displacement of the right side of the body of the mandible. The results of routine laboratory examinations were within normal limits.

Roentgenographic examination of the jaws and facial bones revealed a bilateral compound fracture of the mandible (fig. 9). There was no evidence of fracture of other bones of the face.



Figure 9.—Roentgenographic view of a bilateral compound fracture of the mandible. The lower impacted third molar is in line of fracture. The other fracture is in the canine area.



Figure 10.—Postero-anterior roentgenogram following intra-oral interosseous wiring. The fragments are held in good position.

Operation.—On the day after admission, an arch bar was wired to the teeth of the lower dental arch, and similarly an arch bar was attached to the teeth of the upper dental arch. Under conduction and infiltration anesthesia the lower impacted third molar which was in line of fracture was removed. The mucoperiosteum was elevated and retracted buccally, exposing the buccal plate of the body and ramus of the mandible. Intra-orally, a small hole was made with a

surgical drill through the cortical plate of bone in each of the fracture segments. Through these holes was passed a 24-gage stainless steel wire. The fracture was then reduced by manual manipulation, and corrected relationship was maintained until the wire had been sufficiently tightened to hold the posterior fragment in normal relationship with the body of the mandible (fig. 10). This brought about a hair-line reduction of the fracture. Intermaxillary elastics were placed between the upper and lower arch bars. These elastics were replaced on the fourth postoperative day by double intermaxillary wires passed over the arch bars.

Postoperative course.—There was no elevation of temperature on the day following the operation, but there was a moderate amount of swelling of the soft tissues, which quickly subsided. The patient was given penicillin in the amount of 25,000 units intramuscularly every 3 hours, for a period of 5 days. The supportive treatment consisted of an adequate intake of a high-vitamin, high-calorie liquid diet. Codeine sulfate, $\frac{1}{2}$ -grain, with aspirin, was given for sedation.

Intermaxillary immobilization was maintained for a period of 5 weeks, at which time the jaw was firm and the fracture apparently had healed. The arch bars were then removed from the upper and lower dental arches. Several days later a small incision was made in the soft tissues of the third molar area, the mucoperiosteum was elevated and retracted, and the small piece of stainless steel wire was cut and removed. The fragments were in excellent position and all structures seemed normal and healthy.

REFERENCES

1. RAULT, C. V.: Fibrin foam as clinical aid in dental surgery. *J. Am. Dent. A.* **33**: 1419-1422, Nov. 1, 1946.
2. KEEFER, C. F., et al.: Penicillin in treatment of infection; report of 500 cases. *J. A. M. A.* **122**: 1217-1224, Aug. 28, 1943.
3. IVY, R. H., and CURTIS, L.: Recent experiences with skeletal fixation in fractures of mandible. *J. Oral Surg.* **1**: 296-308, Oct. 1943.



ACUTE DISSEMINATED LUPUS ERYTHEMATOSUS

Occurring in a Male, with Fatal Termination in Sixteen Days

ROBERT K. MOXON
Lieutenant (MC) U. S. N.

Acute disseminated lupus erythematosus is a relatively uncommon constitutional disease occurring almost exclusively in young women. Though subject frequently to a remitting course, fatal termination is the rule.

It is characterized by high fever, prostration, arthralgia and gastrointestinal symptoms. Frequently, but not invariably, it is associated with an erythematous eruption of the face, scalp, upper anterior chest, and hands.

Anemia, leukopenia, thrombopenia, albuminuria, and microscopic hematuria are frequently associated findings. Leukocytosis occurs only with intercurrent infection or terminally.

Gross pathologic changes in the viscera are often lacking except when one finds the characteristic endocardial lesion of Libman and Sacks (1). Fibrinoid degeneration of the connective tissue, as described by Klemperer, Pollack, and Baehr (2), constitutes the essential pathologic lesion microscopically.

The previously held tuberculous etiology has been largely abandoned in this country, although it still remains in favor in certain parts of Europe. The question of an allergic basis for the disease has been raised in view of the superficial microscopic similarity to periarteritis nodosa, but this remains a disputed point (3).

CASE REPORT

L. S., a 35-year-old white male of Polish extraction, was seen on 10 July 1947. He had been admitted the previous night, sent in with an eruption of the face, and complaining of pain in the abdomen and back, nausea, vomiting, fever, and chills of 8 days' duration. He had been perfectly well until 3 months previously when, following penicillin irrigation of the paranasal sinuses for chronic sinusitis, he had noted a small red "blotch" on the left cheek. At this time he had complained of occasional headache, but was otherwise asymptomatic.

The lesion on the left cheek slowly enlarged over the following weeks, but he remained otherwise well until 2 July. At this time he was suddenly prostrated with high fever, chills, general malaise, nausea, vomiting, and rapid spread of the facial skin involvement. He remained at home until 9 July when, because of persistence of these symptoms and the addition of pain in the abdomen and back, he was brought to the hospital.

Examination revealed a dehydrated, semi-stuporous white male, complaining weakly of pain in the abdomen and back. The temperature was 102.4° F., pulse 112, and respiration 40. Over the upper half of the face, involving the bridge of the nose and spreading laterally to the malar prominences, was a somewhat infiltrated acutely erythematous eruption. The forehead and scalp were similarly affected. The ears were beefy red and edematous, with superficial exfoliation, while the face was moderately edematous in toto. On the lips were several sharply demarcated erythematous macules approximately 1 cm. in diameter. Similar macules were seen on the palms. The remainder of the skin was unaffected. The pharynx, tonsils and tongue were dry and beefy red. The chest was clear and resonant throughout. Over the apex of the heart, which was not perceptibly enlarged, a soft systolic murmur was heard. The abdomen was moderately distended and was exquisitely tender throughout. There was marked costovertebral tenderness bilaterally. No other abnormalities were noted.

Since the informant (the patient's wife) stated that there had been no apparent production of urine for the previous 6 days, the patient was catheterized. Six hundred cubic centimeters of clear, dark urine was obtained and an indwelling Foley catheter inserted.

Laboratory studies on admission: red blood cells 4.58 million, with 12.5 gm. hemoglobin; white blood cells 5,050, with polymorphonuclears 63, band forms 7, lymphocytes 29 and monocytes 1; blood urea nitrogen 16.5 mg. percent. The urine



Figure 1.

contained a slight trace of albumin and occasional erythrocytes. X-ray examination of the chest revealed no abnormalities.

The diagnosis was established on the basis of the nature and distribution of the skin lesions in combination with the acute toxicity and leukopenia. The Chief of the Dermatologic Service concurred in the diagnosis and aided in outlining the course of treatment as follows: 1. Continuous oxygen tent. 2. Two thousand cc. of 5 percent dextrose in normal saline per day intravenously, in which was incorporated sodium sulfadiazine 10 gm., thiamine chloride 0.2 gm., and sodium ascorbate 0.6 gm. 3. Amigen, 1,000 cc. per day intravenously. 4. Whole blood 250 cc. every other day. 5. Pyribenzamine 0.05 gm. every 3 hours. The latter was well tolerated by mouth, as were fluids in small quantities.

Following the restitution of hydration, which was attained within 24 hours, no improvement was noted on the above regimen, and with progressive rise in fever the patient lapsed gradually over a period of 2 days into a delirious state. He pulled out his indwelling catheter frequently and required morphine grain $\frac{1}{4}$ for pain 3 or 4 times a day.

On 12 July there was a short episode of coughing productive of thin, mucoid, blood-tinged sputum. No acid-fast bacilli were found. At this time there was some partial fading of the palmar lesions while purpuric changes appeared in the facial eruption. The only new skin lesion noted was an irregular, 4 cm. purpuric area on the left buttock. Passive motion of the extremities at this time produced excruciating pain in the corresponding joint. There was no periarticular swelling, local heat or other objective manifestation of joint

disease. Although acutely disoriented, there was continued complaint of pain in the abdomen and back, but there was no change on repeated physical examination except for moderately hyperactive intestinal peristalsis. Fluids and pyribenzamine continued to be taken by mouth sporadically.

By 14 July the temperature had risen to 104.6, and the leukocytosis to 11,300. Arthralgia became progressively severe.

On 15 July: red blood cells 3.92 million, with 11.5 gm. hemoglobin; white blood cells 9,600; platelets 172,480. Subsequent urine examinations showed no further albuminuria or hematuria. Cyanosis of the lips and further progressive purpuric changes in the facial eruption were noted at this time.

By 16 July the delirium had progressed into a maniacal state and the patient became controllable only after an intramuscular injection of sodium amytal grain 7½.

By 17 July he had lapsed into a coma. The respirations became shallow and irregular, the pulse thready and almost unobtainable, and with persistence of the fever and deepening cyanosis, death occurred at 1910.

PATHOLOGICAL REPORT

The principal gross findings were as follows: *Lungs*: Numerous petechial and hemorrhagic areas over the visceral pleura of the left lower lobe. Marked edema and congestion of both lungs, with areas of consolidation and hemorrhage in the left lower lobe.

Heart: Small verruca-like growth on the mitral valve at the edge of the leaflet. Small plaques in both coronary vessels.

Spleen: Marked congestion.

Lymph nodes: Enlargement of hilar, peri-pancreatic, iliac and lower abdominal nodes.

Gastro-intestinal tract: Small petechial hemorrhages from terminal esophagus through entire tract as far as transverse colon.

Gastro-urinary tract: Swelling and congestion of the renal parenchyma bilaterally. Hemorrhagic area in bladder with small area of ulceration.

Microscopically, the over-all picture was one of marked connective tissue reaction around the blood vessels in all the organs examined. There was also "wire-looping" in the capillaries of the renal glomeruli, hemorrhagic areas in the lungs, gastro-intestinal tract and bladder, terminal bronchopneumonia and myocardial fibrosis.

COMMENT

The case presented, clinically and pathologically, is one of acute disseminated lupus erythematosus. Its occurrence in the male is considered very unusual, in view of its over-all uncommonness and its 95 percent predilection for the female.

REFERENCES

1. LIBMAN, E., and SACKS, B.: A hitherto undescribed form of valvular and mural endocarditis. *Arch. Int. Med.* **33**: 701-737, June 1924.
2. KLEMPERER, P.; POLLACK, A. D., and BAEHR, G.: Pathology of disseminated lupus erythematosus. *Arch. Path.* **32**: 569-631, Oct. 1941.
3. BAEHR, G., and POLLACK, A. D.: Disseminated lupus erythematosus and diffuse scleroderma. *J. A. M. A.* **134**: 1169-1174, August 2, 1947.



A CASE OF MIGRAINE WITH LESION LOCALIZED IN THE VISUAL TRACT

WILLIAM L. BERKLEY

Captain (MC) U. S. N.

and

ROBERT D. GILLIAM

Lieutenant (MC) U. S. N.

Migraine involving the visual tract is a frequently encountered clinical entity. The findings in this case, especially the localization of the lesion by perimetry, electroencephalography, and pneumoencephalography, are considered to be of sufficient interest to justify report and discussion.

CASE REPORT

A white male, age 33, chief machinist's mate, USN, was admitted to the sick list on 30 October 1946 because of intermittent, incapacitating episodes of headache with accompanying symptoms. The condition had existed 22 months, and was characterized by the sudden onset of severe weakness, vertigo, and diaphoresis associated with a generalized sensation of warmth. The attacks usually occurred about noon or toward evening and were accompanied by a frightening dimness of vision with bilateral constriction of the visual fields. Within 3 to 5 minutes there developed a severe headache which originated in the right or left supra-orbital area and radiated temporally to the occipital area. Fifteen to 30 minutes later the attack regressed and all symptoms disappeared except a residual headache which persisted for 1 or 2 hours. The attacks varied in severity and occurred approximately at monthly intervals. The more severe attacks were accompanied by a transient scintillating scotoma which involved the right visual fields. However, no residual field defect could be demonstrated on subsequent studies until a severe attack, 3 months prior to the present admission, resulted in a bilateral right upper quadrant anopsia.

Past medical history included a head injury at age 10 when the patient was struck by a baseball bat and rendered unconscious for 3 days. Four years ago a head injury by a blackjack left him unconscious for 3 hours.

Family history revealed that his father experienced episodes of migraine similar to his own, and died at the age of 44 of cardiac disease. His mother, now 60, has had diabetes mellitus for 10 years.

The patient smoked two or more packs of cigarettes per day.

Physical examination revealed an obese white male 67 inches tall and 200 pounds in weight. An interesting and rare incidental finding was a vascular anomaly of the left upper extremity, which was cooler than the right, and in which the radial pulse could not be detected, nor the blood pressure recorded. Plethysmographic studies were normal, but an angiogram failed to show a left subclavian artery. The condition was considered a congenital absence of the left subclavian artery. Repeated blood pressure recordings indicated an intermittent mild hypertension which elevated to as high as 170/110 following exercise, emotional disturbance, or excessive smoking.

Ophthalmological examination was essentially negative except for the perimetric studies which revealed a constant right superior homonymous tetranopsia. Other special examinations and studies were conducted and positive findings noted as follows:

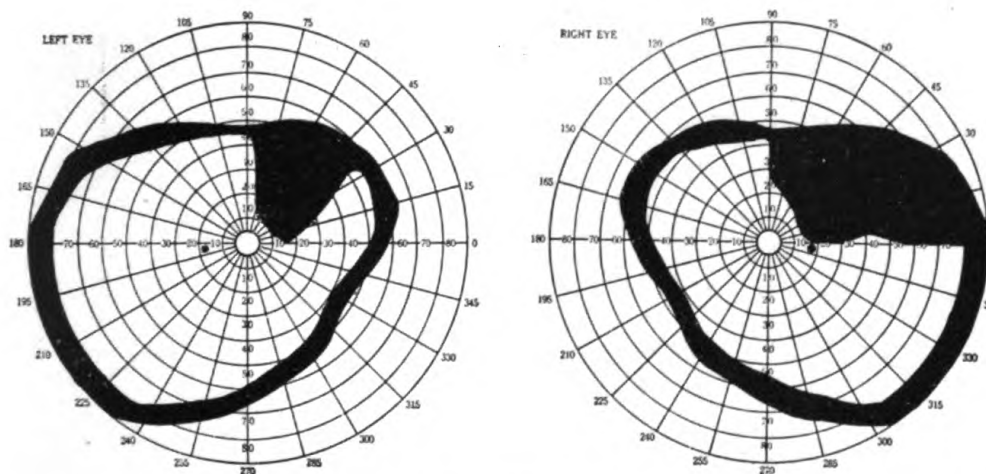


Figure 1.—Showing right superior homonymous quadrant anopsia, sparing of the macular area, and irregular margins.

Skin tests for allergies indicated the patient's sensitivity to hormodendrum, timothy, and shrimp.

A pneumoencephalogram showed good filling of the ventricular cavities, the basal cisternae, and the cortical arachnoid pathways; but there was some dilatation of the occipital horn of the left lateral ventricle, and the cortical subarachnoid pathways on the left side were unusually prominent. The findings were consistent with cortical atrophy on the left side; however, it is well to remember that the occipital horn is the most variable portion of the lateral ventricle and this may have represented a normal variant.

The electroencephalogram (fig. 4) was of particular interest. The report stated that there was a depression of activity in the P_rO_1 area but that the area of damage must not have been great as the other occipital and parietal leads failed to demonstrate it.

Other special examinations including skull x-rays, spinal fluid studies, blood Kahn test, dental examination, and stereoscopic views of the optic foramina, indicated no abnormalities.

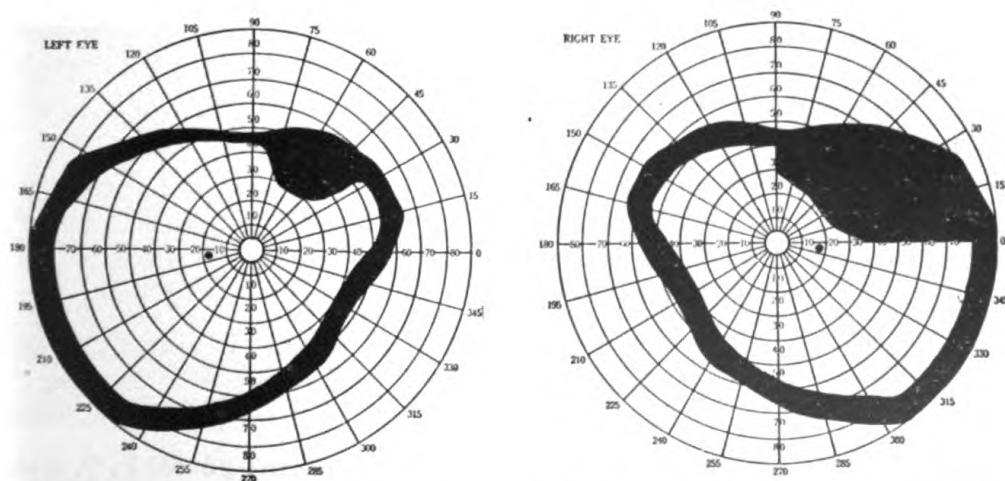


Figure 2.—Charted 3 weeks after figure 1. Note regression of the field defect.

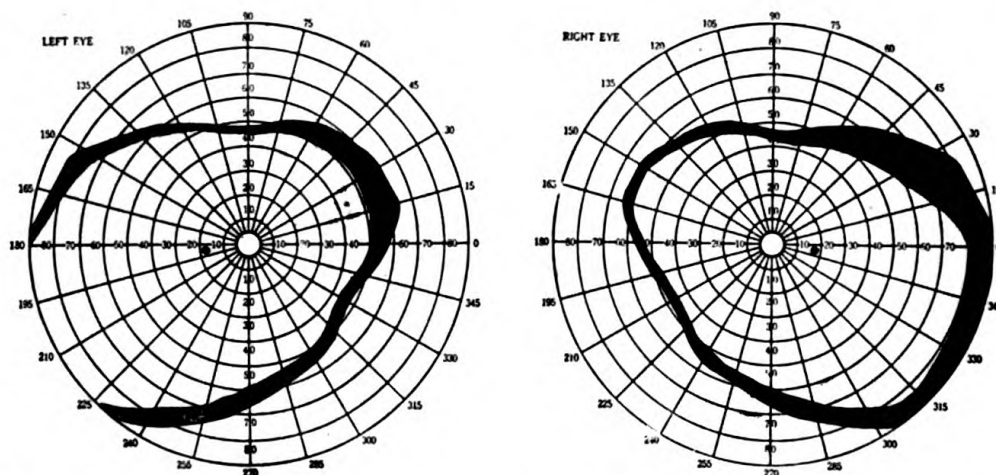


Figure 3.—Charted 9 weeks after figure 1. Note return to practically normal visual fields.

The patient was placed on a low caloric reducing diet; use of tobacco was discontinued except for an occasional "denicotinized" cigarette; and, desensitization to the above indicated allergic substances was undertaken. Following this regime the patient made an uneventful and complete recovery.

Repeated visual field and electroencephalographic studies during hospitalization indicated the lesion to be regressing. The brain waves and the peripheral vision gradually returned to normal (figs. 1, 2, 3, and 5).



Figure 4.—Electroencephalogram showing depression of activity in the P₃-O₁ area.

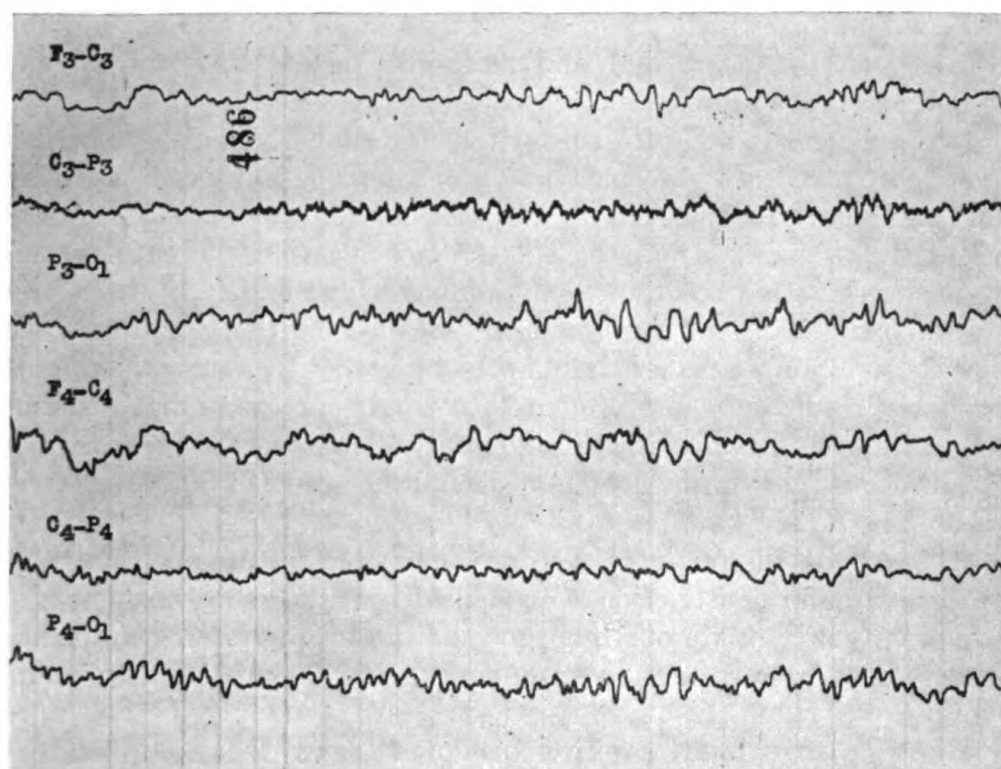


Figure 5.—*Electroencephalogram, recorded 9 weeks after figure 4, showing return to normal activity in the P₃-O₁ area.*

DISCUSSION

The case presented offers a multiplicity of interesting problems including: (1) the theory of the basic pathology involved; (2) the causative factor or factors responsible for this pathological change; and (3) the cerebral localization of the offending lesion.

As no constant lesion has been found in patients suffering from ocular migraine the immediate process is considered most probably to be of circulatory origin. Noyes' case had attacks of migraine for 10 years. Eventually, in a severe attack, left homonymous hemianopsia followed. At autopsy a thrombus was located in the right cuneus. Similar cases have appeared in the literature from time to time. It is assumed that migraine, in such cases, is due to an angiospasm in the cuneus, and in frequently repeated attacks of migraine a permanent occlusion of the vessels with resultant softening of the brain tissue has precipitated a permanent field defect.

The transient ocular palsies, the momentary hemianopsias, aphasias, and scotomata offer support to the supposition of the occurrence of vascular spasms, as does the absence of pathological findings in uncomplicated migraine.

Facial pallor which frequently accompanies the attack, and the constriction of the retinal and temporal vessels also support the hypothesis that migraine is of vascular origin.

It is a generally accepted theory that the fundamental pathological change involved is a vasoconstriction or angiospasm of vessels within the cranium. To theorize on the case herein presented, probably all of the patient's attacks except the last one followed intracranial angiospasm with a resultant temporary cerebral ischemia which precipitated the transient hemianopsia. But during the last attack, the vasoconstriction was so severe and prolonged that the cerebral ischemia probably resulted in impairment of a small portion of brain tissue, which tissue eventually, in approximately 6 months, recovered leading to a disappearance of the hemianopsia and the return of normal electroencephalographic waves.

In regard to the factor or factors responsible for precipitating this sudden vascular constriction a myriad of hypotheses are propounded which only accentuate our ignorance of the true nature of migraine.

Heredity, directly or indirectly, is probably an important etiologic factor.

Migraine often appears to be a form of allergy. It is theorized that an intracranial urticarial-type of reaction may occur.

There is some evidence that hypersecretion of various hormones, especially those of the pituitary, may be an etiological factor of a migrainous attack.

Such factors as infectious diseases, metabolic disturbances, anemia, fatigue, anxiety, and depression are mentioned as possible etiologic agents.

A single etiologic force cannot be condemned as the trigger mechanism leading to the vasoconstriction in the case at hand because a number of possible offending factors are in evidence.

First, the hereditary or familial predisposition to the disease is present, the patient's father having suffered for years from a migrainous-type of headache.

Second, the patient reacted in a hypersensitive manner to various substances tested, indicating that allergy cannot be excluded as a possible exciting agent.

Third, the patient exhibits an intermittent hypertension which may begin, sustain, or prolong the cerebral angiospasm, assuming that angiospasm is the fundamental basis of migraine.

Fourth, as he is a confirmed smoker, nicotine sensitivity must be kept in mind.

Fifth, this man has a proved vascular anomaly, namely the absence of the left subclavian artery. One anomaly does not presuppose another but the possibility of a cerebral vascular irregularity must at least be mentioned.

This case is therefore complicated by the several possibilities which may have a bearing on the etiology, namely, heredity, allergy, hypertension, and a vascular anomaly.

To attempt to localize somewhere along the optic pathways the site of the lesion which resulted in the field defect presented is an interesting undertaking.

Figure 1 shows an homonymous right upper quadrant anopsia. Referring to figure 6 it is readily seen that a single responsible lesion producing such a defect must be postchiasmal and may be in (1) the left optic tract, (2) the left lateral geniculate body, (3) the left optic radiation, or (4) the left occipital cortex.

Accurate localization in one of these four sites may be attempted by following the criteria set forth by various students of perimetry. It is often stated that the various types of homonymous anopsias resulting from lesions in any of these localities have special characteristics.

The Wernicke pupillary phenomenon is of course present in lesion 1, debatable in 2, and absent in 3, and 4 of figure 6. In this case the phenomenon was absent, thus placing the lesion above the primary centers.

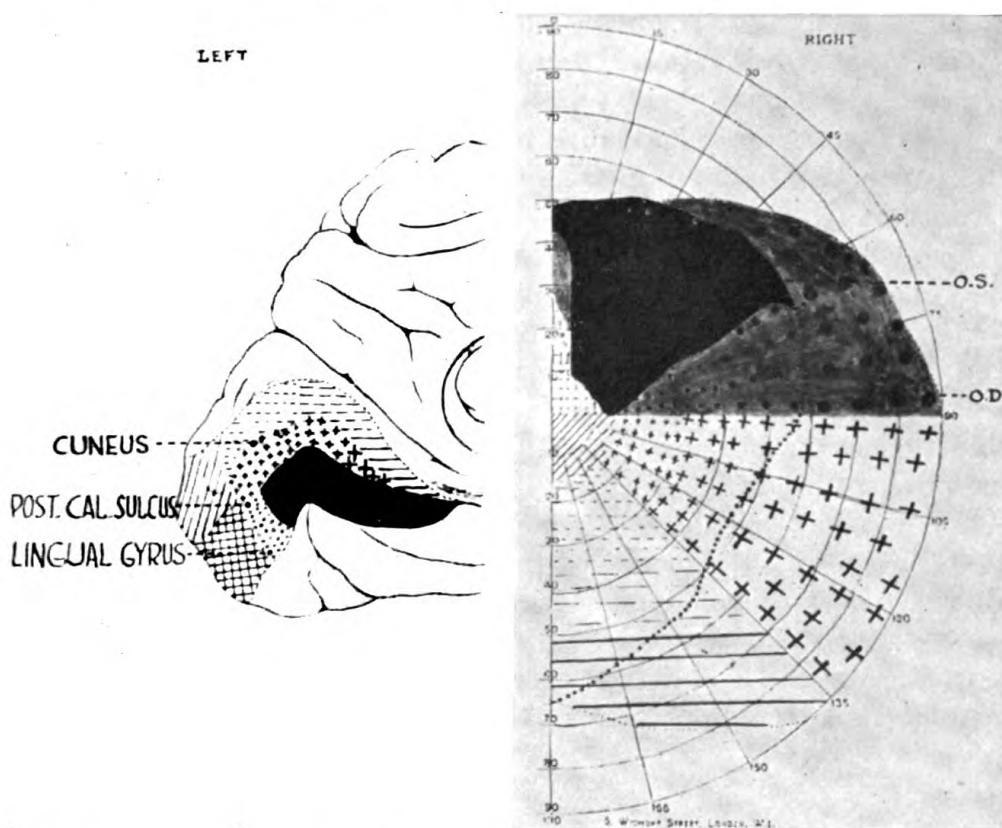
Optic atrophy, often a valuable localizing criterion, was not demonstrable in this case. However, the pathological changes were not of long standing and thus this factor is of little or no significance here.

It is a well known anatomical fact that the optic tract is quite a compact nerve bundle and any lesion affecting it, though small in extent usually produces a complete homonymous hemianopsia. This case presents but a quadrant anopsia which would tend to place the lesion out of the optic tract.

It is also a fairly well accepted theory that in tract lesions, due again to the compactness of the bundle, the central or macular vision (papillomacular bundle) is quite frequently impaired. In this case there is a definite sparing of the central or macular vision which would again tend to exclude the optic tract as the probable site.

The macula is extensively represented in the lateral geniculate body and a lesion here would usually cause not only an homonymous hemianopia, but central scotomata as well. Here again this case would be excluded from the site mentioned in this statement as neither criterion is present in the perimeter charting.

Homonymous quadrant hemianopia with rectilinear delimitation along the vertical and horizontal meridians of the fields is regarded as due to a lesion of the geniculocalcarine tract. Irregularity of outline and steepness of the margins indicate damage of the cortex. In injuries of the radiation, the clean-cut straight margins of quadrant anopsias indicate the probability that the fibers corresponding to the upper and lower retinal quadrants may be separated anatomically whereas in the cortex there is no anatomical reason why a quadrant



—Adapted from Gordon Holmes' diagram as illustrated in "Clinical Perimetry," by H. M. Traquair. C. V. Mosby Company, St. Louis, Mo.

Figure 7.—Diagrammatic representation of the retina as projected onto the cortex. The right upper quadrant corresponds to the ventral portion of the calcarine fissure, the site of the lesion in the case presented.

hemianesthesia, pain in the extremities, etc. The case presented had no hemiplegias, paresthesia, or anesthesia, which points against the probability of a lesion in the optic radiations near the internal capsule.

It is noted that the weight of the evidence presented thus far indicates the site of the lesion responsible for the picture in this case (fig. 1) to be above the geniculocalcarine tracts (optic radiations) that is, in the cortex (fig. 6).

Figure 1 depicts a definite sparing of the macula or central vision. Most authorities are agreed on the cortical location of the lesion which spares the macula. In lesions of the chiasm and tract the dividing line of the hemianopsia usually passes through the fixation point or escapes it by a narrow margin. In involvement of the radiations or cortex, however, the entire macula, including the fovea centralis, often escapes.

The popular explanation for this phenomenon is based on a wide cortical representation of the macula and on a dual blood supply. The macular fibers pass to the most occipital part of the calcarine fissure and are continued on the outer surface of each occipital pole. The

posterior cerebral artery alone supplies the calcarine fissure, whereas the occipital pole is supplied by the posterior and the middle cerebral arteries. This dual blood supply insures protection to the macular area. If one artery is occluded by embolus, thrombus, or spasm the other artery continues to nourish the macular area and thus the maintenance of central vision and the sparing of the macula is assured.

In reviewing the foregone perimetric localizing criteria, the site of the offending lesion would most probably be placed in the left occipital cortex in the region of the ventral portion of the calcarine fissure (fig. 7).

To add weight to this cerebral localization of the lesion by perimetric charting are the findings of the electroencephalogram and the pneumoencephalogram.

The electroencephalogram reported a depression of activity in the P_3-O_1 area which coincides with the perimetric localization noted above. The pneumoencephalographic findings were consistent with some cortical atrophy to the left side.

At present, the field defect has completely disappeared and the patient has been asymptomatic for 1 year's duration.

SUMMARY

A case of ocular migraine exhibiting an homonymous quadrant anopsia is presented. A short review of the possible pathology and etiology involved is given. The site of the cerebral lesion is localized and confirmed by perimetry, electroencephalography, and pneumoencephalography.



GANGLIONEUROMA

Report of a Case of Intrathoracic Ganglioneuroma

VINCENT L. BARKER

Commander (MC) U. S. N. R.

and

HENRY J. CAES

Lieutenant Commander (MC) U. S. N.

The occurrence of intrathoracic ganglioneuroma without the production of symptoms has been infrequently reported (4). The following case, that of an asymptomatic intrathoracic ganglioneuroma, is of interest in that it was discovered during routine roentgenog-

raphy, as mentioned by Gray et al. (6), and because of its relative rarity. It is reported in order to add another case to the few already recorded in the literature. The pathology and incidence of these tumors are well discussed by McFarland (2), Dunn (3), Riggs and Good (4), and Gray et al. (6).

CASE REPORT

The patient, a 13-year-old white male was first seen in the out-patient clinic on 31 October 1944. He had just previously been a patient in a state mental hospital with the diagnosis of kleptomania. There a routine chest x-ray revealed a mediastinal mass, and he was referred to this hospital for further treatment on 10 November 1944.

A careful history elicited no complaints referable to the patient's chest, and the rest of the history was noncontributory.

The physical examination revealed a well-developed, but somewhat underweight and undernourished, 13-year-old white male who otherwise did not appear ill. No other abnormalities were detected.

X-ray studies revealed a large, smooth, well-circumscribed tumor mass in the upper right side of the posterior mediastinum in a position corresponding to the midportion of the lung field. Lipiodol studies were negative.

The blood Kahn test was negative, the sedimentation rate and urinalysis normal. The blood count revealed a slight secondary anemia.

The preoperative diagnosis was either a neurofibroma or a dermoid cyst.

On 29 November 1944 after preparation for surgery, including a transfusion of 500 cc. of citrated whole blood, the posterior mediastinum was explored by Dr. V. L. Barker through an incision in the seventh, right, posterior intercostal space. The anesthesia used was nitrous oxide gas-ether with an intratracheal tube in place. The tumor was found projecting from the posterior thoracic wall about 2.0 cm. to the right of the spinal column from the third to the seventh intercostal space. It was covered by pleura and was compressing the adjacent lung. The pleura was split and the tumor removed by blunt dissection. No excessive bleeding was encountered, but because the tumor was infiltrating the musculature it was difficult to remove.

Immediate postoperative recovery was good. However, he subsequently developed a moderate hemothorax requiring aspiration. By 29 January 1945 he made a complete recovery. He was last seen in the out-patient clinic on 22 March 1945, at which time he was well.

PATHOLOGY

Gross.—The tumor (fig. 1) is an ovoid mass measuring 9.0 by 6.0 by 3.0 cm. One surface is covered by pleura. The other surface is rough and nodular. It cuts with increased resistance. The cut surfaces have a white fibrous appearance with a few areas containing minute flecks of yellow tissue. The edges of the tumor appear hemorrhagic. Through one edge of the tumor is a nerve-like structure 0.5 cm. in diameter surrounded by concentrically arranged bands of white fibrous tissue.

Microscopic.—The microscopic diagnosis was made by Commander C. F. Geschickter (MC) USNR and his description follows. The sections show the tissue to be made up chiefly of wavy fibrils of the type derived from nervous tissue. In some areas they are moderately compact while in others are present in small amounts. The nuclei of both the thin and compact fibrils are small, pale-staining and benign in character. Embedded in the nerve sheath tumor are collections of



Figure 1.—Mediastinal tumor mass in gross.

large ganglion cells. In places these ganglion cells appear to be proliferating since there are binucleated forms and occasional large nuclei. There are small islands of calcification. In addition one of the authors noted in other sections, islands and patches of small round cells within a reticular stroma. These have a large round nucleus with scanty cytoplasm and are small in size. A few of these appear to have a branching cytoplasm. These are probably neuroblasts.

Histopathological diagnosis.—Ganglioneuroma with ganglion cell proliferation arising in the thoracic sympathetic chain.

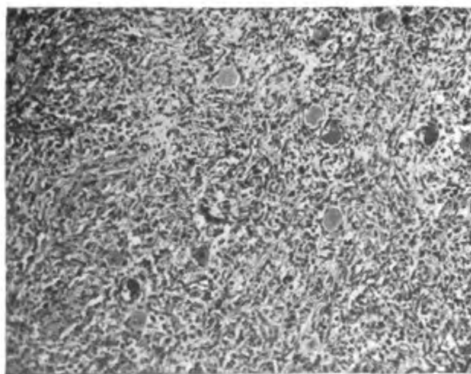


Figure 2.—Low power microphotograph showing ganglion cells.

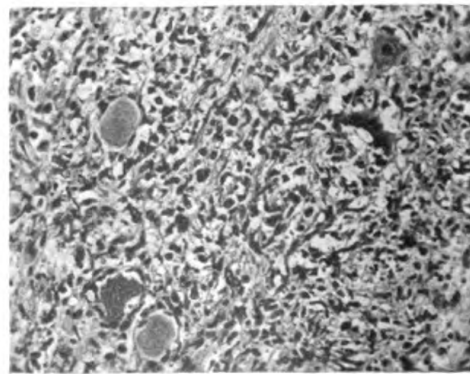


Figure 3.—High power microphotograph showing ganglion cell.

COMMENT

Ganglioneuromas belong to a group of peripheral nerve tumors derived from the neural crest cells (1) of the neurectoderm of the embryonic medullary tube and closely associated with the peripheral sympathetic nervous system. The others are: sympathoblastomata, the sympathogonioma, paraganglioma, the pheochromocytoma. The ganglioneuroma, paraganglioma, and pheochromocytoma represent the more benign members of the group although malignant varieties have been reported.

The tumors occur almost always in the course of the main sympathetic trunks and cranial nerves (1), retroperitoneal, thoracic (4), and cervical sympathetic trunks. They have also been reported intracranially, intraspinally, and from the adrenals (3), alimentary tract (5), and lungs.

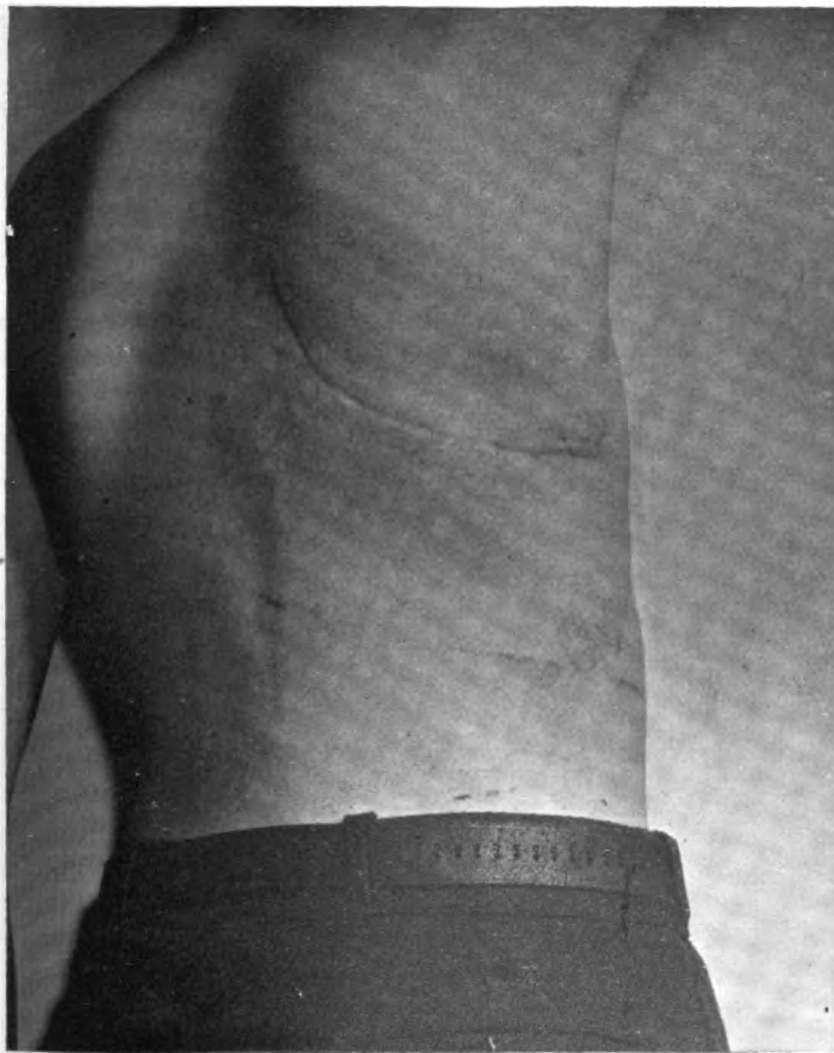


Figure 4.—Healed scar of operative incision to show operative approach.

The tumors occur usually in the younger age groups, before the age of 30 years with the greatest percentage before 20 years.

Grossly the tumors resemble large solitary neurofibromata. They are frequently incompletely encapsulated by a thin fibrous capsule and have a lobulated appearance. The cut surfaces show white fibrous strands among which may be seen occasional islands of small yellow flecks of tissue.

This histopathological structure is not difficult to recognize. Lying within a stroma composed of medullated and non-medullated nerve fibrils are noted varying numbers of groups of typical ganglion cells. The nuclei are usually benign although some are binucleated. The architecture of the stroma resembles that of a neurofibroma. There also may be noted patches of lymphoid cells lying within a reticular stroma. These have been variously interpreted as lymphocytic cells and neuroblasts. Our specimen shows similar patches of cells.

SUMMARY

1. A case reported of an intrathoracic ganglioneuroma is presented.
2. The pathology of the case is discussed.

REFERENCES

1. EWING, J.: Neoplastic Diseases. 4th edition. W. B. Saunders Company, Philadelphia, Pa., 1940.
2. MCFARLAND, J.: Ganglioneuroma of retroperitoneal origin; report of case with bibliographic references to 93 similar tumors. *Arch. Path.* 11: 118-124, Jan. 1931.
3. DUNN, J. S.: *J. Path. & Bact.* 19: 456, 1945.
4. RIGGS, T. F., and GOOD, L. P.: Ganglioneuroma of mediastinum requiring surgical intervention for relief of obstructive symptoms. *Arch. Surg.* 19: 309-320, Aug. 1929.
5. POATE, H., and INGLIS, K.: Ganglioneuroma of the alimentary tract. *Brit. J. Surg.* 16: 221-225, Oct. 1928.
6. GRAY, H. K.; SHEPARD, D. V.; and DOCKERTY, M. B.: Mediastinal ganglioneuroma. *Arch. Surg.* 48: 208-213, Mar. 1944.



FATAL ANAPHYLAXIS FOLLOWING TYPHUS VACCINE INJECTION

RUSSELL H. WALKER

Commander (MC) U. S. N.

Allergy to various foods has been known for many years and extensively studied by many. Death in anaphylactic shock was reported following injections of serum and pollen by Waldbott (1) and Joyce (2) and from intravenous injection of typhoid vaccine used for the treatment of arthritis by Ziskind and Schattenberg (3). A review of anaphylactic shock and death is given by Vaughn (4), and there have been articles and reports on death from intracutaneous injections by Hunt (5) and Swineford (6). Swineford states that every intradermal test should be preceded by the less sensitive scratch test.

Since egg cultured vaccines have come into use, Swartz (7) reported a systemic reaction in an individual who was sensitive to egg white and chicken meat following an injection of yellow fever vaccine, and Sulzberger and Asher (8) reported three cases of urticaria and erythema multiforme-like eruptions following its use. Rubin (9) reported a reaction following typhus vaccine consisting of painless swelling of the face, blocking of the nose, and pain in the chest. The onset of these symptoms was 1½ hours after the patient received the injections. The pain in the chest lasted 5 minutes, and the swelling of the face persisted for 2 days.

Although the observation of the case presented in this article is incomplete, there is adequate reason to believe that his death was due to the injection of typhus vaccine. He had received no previous injections of typhus vaccine.

CASE REPORT

A 20-year-old white male, stationed aboard a small vessel, was given the first injection of 1 cc. of typhus vaccine on the way to a port in the Far East. The injection was administered by a hospital corpsman who was trained in giving injections, due to the fact that no medical officer was attached to the ship. According to the corpsman, the injection was made with sterile technique and the plunger on the syringe was retracted after the needle pierced the skin with no aspiration of blood. Therefore it is considered that the injection was actually subcutaneous. The injection was given in a routine vaccination of the entire crew, and no other member of the crew became ill in any manner. The recipient made no comment when he received the injection and was observed for approximately 5 minutes afterwards by his shipmates who noticed no change in his personal appearance or any unusual symptom. He made no comment about feeling ill and was not seen again until he was found dead in his bunk in the crew's quarters 26 minutes after he had received the 1 cc. injection of typhus vaccine.

The commanding officer of the ship was questioned and he revealed that the deceased was very sensitive to eggs and could not eat them or any food product

which contained them, and on one occasion he had to be relieved from duty because of accidentally eating some food product containing eggs. He did not reveal the exact nature of his illness but stated that he was "sick." He was relieved from the watch but did not report to the sick bay for treatment so far as could be determined; however, he did report for duty on his next watch and appeared to be normal. A review of the health record showed an injection of yellow fever vaccine had been given previously, and there was no entry of any reaction following this. The commanding officer stated that there was no severe reaction following this as it would have been reported to him. To the best of his knowledge, there was no reaction of any type. There was no request to be relieved from his watch presented by the man on this occasion.

Inquiry among the ship's crew in regard to the man's well being prior to the injection revealed that all who observed him thought him to be cheerful and in excellent health. There was no record of his having been treated for any illness at any time during his enlistment.

Autopsy (34 hours after death.)

The body was well developed and well nourished. The weight was estimated at 150 to 160 pounds. The needle puncture wound was located but no localized area in the subcutaneous tissue could be identified as the site of the injected vaccine. There was no hemorrhage along the puncture tract, nor were there any large veins located in the immediate area. There was no evidence of a rash, edema, or dermatitis on the skin. There were no wounds or bruises on the body or skull and no evidence of a broken neck, nor caustic burns of the lips or tongue. The postmortem suffusions were a dark red color.

The only positive finding of note at the autopsy was the marked congestion of the lungs. The lungs were voluminous and the right lung weighed 1,240 grams, the left lung weighed 1,055 grams. Both lungs were a dark red color. The cut surfaces of the lungs revealed marked congestion and edema. The blood in the heart and great vessels was dark red and mostly unclotted.

Microscopic examination: The microscopic findings that varied from the normal were limited to the lungs. All sections of the lungs showed marked acute congestion. The congestion was so marked that the alveolar spaces were described as being outlined by red blood cells as well as epithelium. There was very little extravasation of the red cells into the alveolar spaces. The alveoli were dilated. The alveolar epithelium showed practically no change from the normal.

Vaccination of naval personnel entering a port where typhus was known or suspected was adopted by the U. S. Navy during the latter part of World War II. In most cases the injection consisted of two subcutaneous doses of 1 cc. each, at intervals of 7 to 10 days. The vaccine consisted of killed typhus rickettsiae cultured by the Cox yolk sac method.

For control of typhus in Italy during 1943 to 1945, Soper, Davis, Markham, and Riehl (10) reported that vaccination was employed in some 26,000 individuals with the 3-dose method, and another 10,000 by the 1-dose method. No reactions to typhus vaccine were reported in their article. Dusting with MYL and DDT louse powder was the main method of control and vaccination was used on a small scale for only a few weeks.

It is interesting to note that this case received yellow fever vaccine without reaction. Yellow fever vaccine is cultivated on the chick embryo, while typhus vaccine is cultivated on the yolk sac. When the typhus vaccine was given, death resulted.

It is unfortunate that a more thorough investigation of this case could not be made, as movements of the ship prevented the author's receiving any further information.

In view of the reactions observed by others and by presenting this fatal case, a recipient of an injection of typhus vaccine or yellow fever vaccine should be questioned in regard to egg and chicken meat allergy prior to the injection.

It appears evident that the catastrophe was caused by anaphylactic shock due to egg yolk in the vaccine.

SUMMARY

A fatal case of anaphylactic shock following a 1 cc. injection of typhus vaccine into an individual who gave a history of allergy to eggs has been presented.

REFERENCES

1. WALDBOTT, G. L.: Prevention of anaphylactic shock, with study of 9 fatal cases. *J. A. M. A.* 98: 446-449, Feb. 6, 1932.
2. JOYCE, S. J.: Critical anaphylactic shock during treatment for hay fever; recovery after 3 intracardiac injections of epinephrine. *Arch. Int. Med.* 60: 974-981, Dec. 1937.
3. ZISKIND, J., and SCHATTENBERG, H. J.: Fatal anaphylactic shock in man. *Arch. Int. Med.* 62: 813-820, Nov. 1938.
4. VAUGHN, W. T.: *Practice of Allergy*. The C. V. Mosby Company, St. Louis, Mo.
5. HUNT, E. L.: Death from allergic shock. *New England J. Med.* 228: 502-507, Apr. 22, 1943.
6. SWINEFORD, O., JR.: Anaphylactic shock from skin testing; two cases—one fatal. *J. Allergy* 17: 24-26, Jan. 1946.
7. SWARTZ, H. F.: Systemic allergic reaction induced by yellow fever vaccine. *J. Lab. & Clin. Med.* 28: 1663-1667, Nov. 1943.
8. SULZBERGER, M. B., and ASHER, C.: Urticarial and erythema multiforme-like eruptions following injections of yellow fever vaccine. *U. S. Nav. M. Bull.* 40: 411-418, Apr. 1942.
9. RUBIN, S. S.: Allergic reaction following typhus-fever vaccine and yellow-fever vaccine due to egg yoke sensitivity. *J. Allergy* 17: 21-23, Jan. 1946.
10. SOPER, F. L.; DAVIS, W. A.; MARKHAM, F. S.; and RIEHL, L. A.: Typhus fever in Italy, 1943-1945, and its control with louse powder. *Am. J. Hyg.* 45: 305, 1947.



SALMONELLA OSTEOMYELITIS

Report of a Case With *Salmonella schottmülleri* as the Etiologic Agent

ROBERT C. ABRAMS

Commander (MC) U. S. N. R.

and

FREDERICK G. GAENSLEN¹

Lieutenant (MC) U. S. N. R.

The involvement of portions of the skeletal system by pathogenic bacteria has usually disclosed the staphylococcus or the streptococcus as the offending agent. But other bacteria have so frequently been indicted that their presence is no longer considered unusual. We wish to report this case because of the rarity of osteomyelitis due to *Salmonella schottmülleri*.

In a review of the literature, few other cases of osteomyelitis due to the *Salmonella* group have been encountered.² Seligmann, Saphra, and Wassermann, (3) working in the New York *Salmonella* Center, give an analysis of 1,000 cases where they bacteriologically isolated organisms of this group from material sent to them from all over the world for identification. In their series 3 cultures obtained from cases of osteomyelitis were proved to be due to *S. typhimurium*, *S. enteritidis*, and *S. Panama* respectively. None were found to be due to *S. schottmülleri*. Schein (1) reported a case in which *S. typhimurium* was isolated from an abscess which formed about a Lane plate of vanadium steel at a considerable interval after union had been achieved in a fractured femur. In a review of the literature, Ecker, Kuehn, and Recroft (2) report that they found only 3 cases of osteomyelitis due to *S. schottmülleri* and add 1 of their own with involvement of the lumbosacral spine. Their own case was the first to be proved by culture and agglutination methods.

CASE REPORT

E. C. W., a 19-year-old colored male, seaman first class, was first admitted to the sick list at a fleet hospital on Guam on 16 January 1946 complaining of headache, high fever, and pain in both upper arms for 1 day, followed by a severe chill. At that time he revealed tenderness over both humeri, pain on movement of his arms, and a temperature of 103° F. His white blood count was 30,400 with 2 percent juveniles, 16 percent bands, 67 percent segmented neutrophils, and 15 percent lymphocytes. The urine was negative, malarial smears were negative, and the spinal fluid was normal. A blood culture taken at that time was reported negative. He was placed on penicillin for 8 days, during which time his temperature ranged from 102°–103° F. daily. On 24 January the penicillin was discon-

¹ Resigned 17 December 1947.

² Since this report was accepted for publication two additional case reports of *Salmonella* osteomyelitis have been added to the literature (4) (5) and in neither case was the organism the same as reported in this case.

tinued. The soreness in his arms gradually subsided while his temperature dropped slowly to normal. On 12 February 1946, after 26 days of hospitalization, he was returned to duty under the diagnosis of "Fever, Cause Undetermined." During this hospitalization no x-rays were taken.

Because he was eligible for return to the United States for discharge, he was sent to a separation center on Guam and put aboard an assault transport. He left Guam on 20 February.

Several days later he felt a sudden pain in his right hip and felt feverish. He reported to the sick bay, where he was found to have a temperature of 102° F. and signs of marked irritation of the right hip joint. A roentgenogram taken with a portable x-ray unit failed to reveal any changes about the hip. He was put on penicillin and sulfadiazine therapy and traction was applied to the right leg. His white blood cell count was 12,650, but the differential was not recorded. He was kept on chemotherapy until 2 March at which time the fever and pain had subsided. However, after stopping the drugs, the signs of hip joint irritation and the fever returned, and on 8 March he was again started on penicillin.

He arrived at the U. S. Naval Hospital, Oakland, Calif., on 12 March and was placed on a "rations only" ward pending transfer to Norfolk, Va. Because of his serious condition he was taken as a patient on the orthopedic service on the evening of his arrival in the States.

When first seen he complained of excruciating pain in his right hip and right inguinal region. He was so uncomfortable that merely touching the mattress brought tears to his eyes, which made examination difficult to perform adequately. His temperature was 103° F., pulse 120, respirations 28, and blood pressure 140/90. The positive physical findings at that time included exquisite tenderness on light touch over the right hip and inguinal region. All motions of



Figure 1.—Right humerus on 2 April 1946. Note massive sequestrum and involucrum.

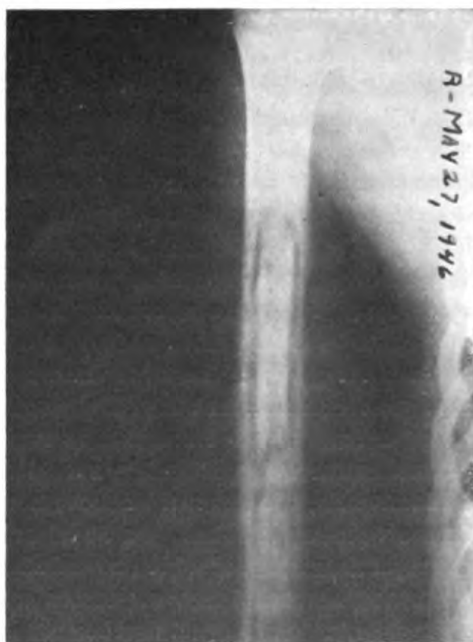


Figure 2.—Right humerus on 27 May 1946. No clear-cut change.

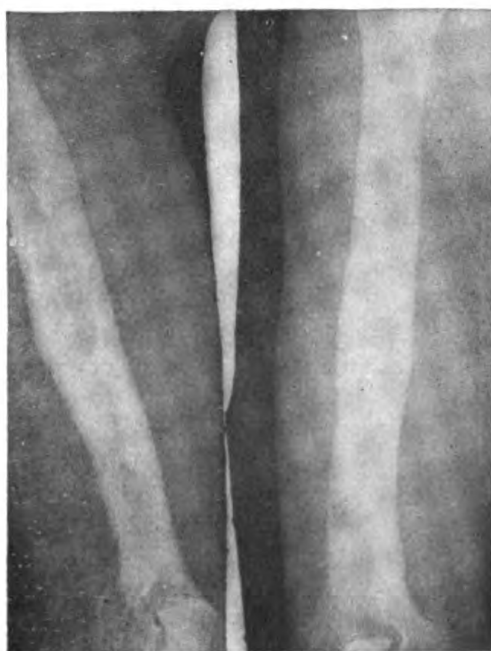


Figure 3.—Right humerus on 31 July 1946. Note healing.

the hip were greatly limited and extremely painful; there was tenderness over the right humerus but no limitation of motion at the elbow or shoulder; the abdomen was moderately distended. The clinical impression was that this was a case of acute osteomyelitis of the head of the femur with secondary pyarthrosis. A blood culture was taken, intravenous dextrose in normal saline was administered, and the patient was started on 40,000 units of penicillin every 2 hours and sulfadiazine 4 grams Stat. and 1 gram every 4 hours thereafter. Sedation was ordered for comfort.

On the following morning an x-ray of the hip confirmed the clinical impression. He was taken to surgery, where surgical drainage of the right hip was done through the lateral approach. After incising the skin the soft tissues overlying the trochanter were pale and glistening because of

massive edema, which poured from the wound. The joint capsule was incised and about 10 cc. of grey, cloudy, thin, watery pus escaped. A culture was obtained from this material. Traction was applied.

From the practical standpoint, the combination of chemotherapy, indicated surgery, and traction led to the rather rapid clinical improvement. Five days after admission his temperature reached normal and remained normal from that time on. The wound in his hip healed rapidly and was closed on 28 March, at which time the signs of acute local infection had subsided. Sulfadiazine was discontinued on 2 April, penicillin on 11 April, and the traction on 16 May. His course in the hospital was less stormy than had been anticipated and it was suspected that the infection was probably caused by an uncommon organism.

Evidence concerning the organism was obtained with much difficulty. The blood and hip culture reports were returned to the ward on the same day. The blood culture revealed gram-negative rods, but this was considered to be a contaminant by the laboratory and the culture was destroyed. The hip culture also grew gram-negative rods, but this was also discarded by the laboratory as a contaminant. By the time these reports were received, the patient's temperature was normal, and his hip wound was overgrown by secondary invaders. Blood cultures were nevertheless repeated, but revealed no growth, and further wound cultures from the hip revealed only the expected secondary invaders.

Meanwhile, the general improvement in the patient's condition permitted more extensive x-ray studies. On 30 March x-rays were taken of both humeri and of the right femur, all of which revealed extensive osteomyelitis. The right humerus contained several large sequestra and a well-developed involucrum about the entire shaft. On 9 April further studies of the right hip revealed progress of the disease with a small sequestrum now visible in the head of the femur. On 28 May x-rays were taken of the entire skeletal system revealing the presence of the disease in various stages of chronicity involving both humeri, both radii, both tibiae, both femora, and the right hip joint.

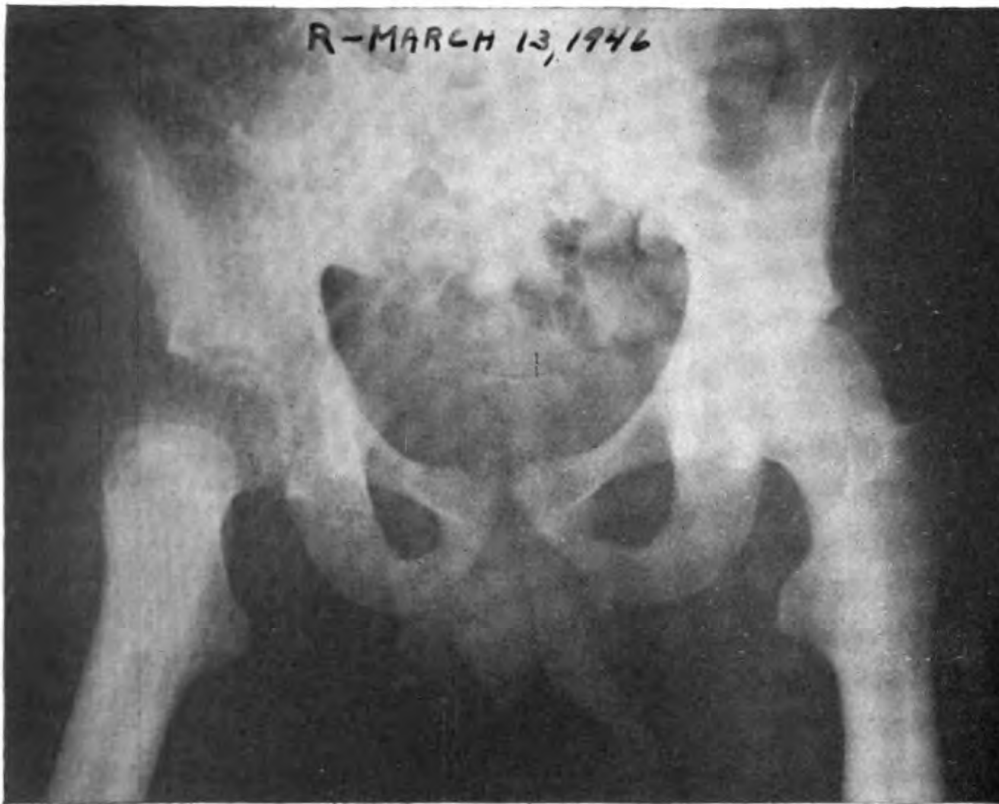


Figure 4.—Pelvis on 13 March 1946. Head of right femur demineralized and irregular. Zone of reaction in acetabulum clearly seen.

With the knowledge that this patient had widespread osteomyelitis, which he was apparently tolerating without the expected severe constitutional symptoms, it was strongly suspected that this was a most unusual form of bacterial invasion. Efforts were renewed to identify the organism involved, using as the major clue the knowledge that it was probably a gram-negative rod. Agglutinations were run and were reported negative for typhoid, paratyphoid A, brucella, and tularensis organisms. Intradermal tuberculin tests were negative in dilutions of 1:10,000 and 1:1,000. Repeated blood cultures were negative. The Kahn test was negative. On 17 May the right humerus was biopsied solely for the purpose of obtaining a pure culture of the organism involved. A small window was cut through the lateral side of the distal third of the right humerus and tissue obtained for culture. The humerus was moth eaten in appearance and the marrow was replaced by a pearly gray amorphous material. The large sequestrum was not disturbed.

Meanwhile, agglutinations were again requested and this time a positive agglutination in the dilution of 1:80 was obtained against *Salmonella schottmülleri*. This antigen had not been available at the time the first agglutinations were run. The unit at Treasure Island identified the culture as *Salmonella schottmülleri*, and agglutinations were run against this organism and against stock antigens. The patient's serum agglutinated the new culture in a dilution of 1:640, and agglutinated the stock antigen in a dilution of 1:80.

In reviewing the patient's past history for evidence of the source of his *Salmonella* infection, no clues have been discovered. He lived all his life in Virginia until he entered the Navy in July 1944. He did duty at Great Lakes,

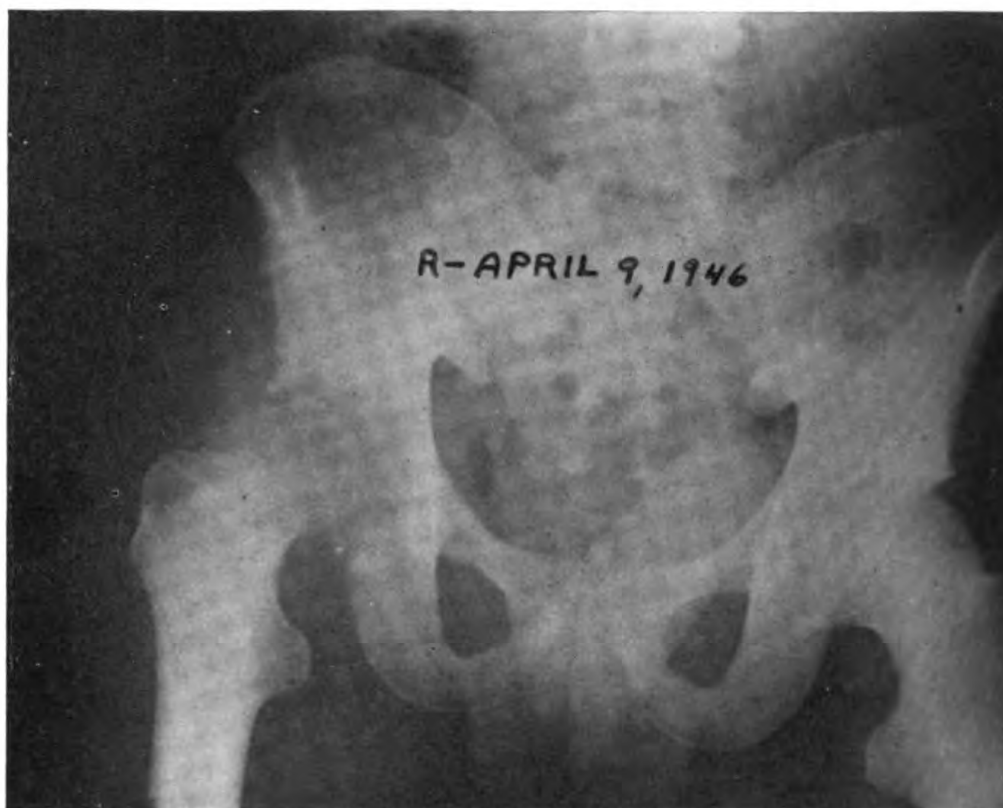


Figure 5.—Pelvis on 9 April 1946. Further progress of infection. Small sequestrum now visible at upper border of head of femur.

Port Hueneme, Okinawa, and Guam. He could recall no history of gastroenteritis, diarrhea, or dysentery. The only illness he ever had was pneumonia at the age of 9, following which he had aching pains in his forearms for many years, but he was never feverish and recalls no pain in his thighs, legs, or upper arms.

By July 1946 the patient has overcome his infection rather well. He feels fine except for an occasional headache; he eats well; he is able to be up in a wheel chair all day without pain. He has slight loss of motion in his right hip joint, but has been allowed to be ambulatory without weight bearing. He has been afebrile since the fifth postoperative day following drainage of the hip. Streptomycin therapy was considered after the organism was identified but was not undertaken because there would be no way to evaluate clinical improvement.

The most recent laboratory studies reveal a white blood count of 9,950 with 4 percent bands, 56 percent segmented neutrophils, 31 percent lymphocytes, 2 percent eosinophils, 1 percent basophils, and 6 percent monocytes. The red blood count is 5 million with 103 percent hemoglobin. The sedimentation rate is 4 mm. in 1 hour. Stool cultures have all been negative for any enteric pathogens. Cultures of the biliary drainage have also been negative.

DISCUSSION

In reviewing this case we find widespread involvement of the skeletal system by osteomyelitis. The septic hip was the most recent area to be involved and a gram-negative rod was isolated, as it was from the blood

culture. The right humerus apparently became involved at the time of his admission to the sick list in January, as attested to by the extensive involucrum formed about the sequestra. Cultures taken from this area have been proved to be *S. schottmülleri*. The lesions of the femora and radii, exclusive of the right hip, are more difficult to place chronologically as to time of involvement. However, from the patient's history we have learned that following pneumonia at the age of 9 he had aching pains in his forearms of many years' duration. When the femora became involved remains a mystery. In view of the commendable resistance the patient has shown to the infection of the right humerus and hip we feel it is safe to presume that the other areas were infected by the same organism. Efforts to locate the focus from which spread has occurred have been negative, and so by exclusion this is presumed to be in one of the infected bone areas.

The patient's clinical response has been unusual in his freedom from symptoms and rapidity of healing. We are certainly without clinical experience in the treatment of *Salmonella* osteomyelitis, and suggest that perhaps the clinical course and resistance shown by the host in this case to organisms of this type may be characteristic.

CONCLUSION

1. We have presented a case of osteomyelitis proved to be due to *Salmonella schottmülleri*.
2. Blood agglutinations were positive in dilution of 1:80 against stock antigen of *S. schottmülleri*.
3. The patient's serum agglutinated the culture in dilution of 1:640.
4. This is, as far as we know, the second case of osteomyelitis due to *S. schottmülleri* on record that has been proved bacteriologically.

REFERENCES

1. SCHEIN, A. J.: Late infection of healed Lane-plated fracture of femur by *Salmonella typhimurium*; Lane plate as locus minoris resistentiae. *J. Mt. Sinai Hosp.* 9: 154-159, Sept.-Oct. 1942.
2. ECKER, E. E.; KUEHN, A. O.; and RECROFT, E. W.: *Salmonella schottmülleri* isolated from sacrolumbar lesion of 24 years' duration. *J. A. M. A.* 118: 1296-1297, Apr. 1942.
3. SELIGMANN, E.; SAPHRA, I.; and WASSERMANN, M.: *Salmonella* infections in man; analysis of 1,000 cases bacteriologically identified by New York *Salmonella* Center. *Am. J. Hyg.* 38: 226-249, Nov. 1943.
4. KRAUSE, R. F.: Osteomyelitis caused by *Salmonella typhimurium*. *J. Bone & Joint Surg.* 29: 227, 1947.
5. VINKE, T. H., and DOWNING, H. F.: *Salmonella* infection involving the knee joint. *J. Bone & Joint Surg.* 29: 232, 1947.



MEDICAL AND SURGICAL DEVICES



A MODIFICATION OF AN ORAL PHOTOGRAPHIC APPARATUS ORIGINALLY CONSTRUCTED BY THE DENTAL SCHOOL, UNIVERSITY OF PENNSYLVANIA

CARL A. SCHLACK
Commander (DC) U. S. N.

From 1939 to 1943 different types of still photographic apparatus for photographing oral lesions and deformities were tried in the U. S. Naval Dental School. This was done in conjunction with a visual educational program which was being vigorously pursued.

On 27 September 1941 a photographic board was appointed by the Medical Officer in Command, U. S. Naval Medical Center, Washington, D. C., to investigate further the possibilities of using visual educational material in the teaching and exhibit program of the Medical Department of the Navy. The report of this board submitted 3 October 1941 revealed the means employed to procure and produce such material, and that several films and series of films (still and motion picture) had already been completed by the Medical Department of the Navy. This report stressed the need for adequate photographic apparatus. Another board was appointed 10 April 1942 to develop further visual educational means.

Although photographic apparatus employed for routine, clinical, still photography was available in the Navy, it was extremely difficult to obtain close-up photographs of the oral cavity. Most pictures included the head and shoulders of the patient. Consequently little or no detail of oral lesions could be obtained.

The experimental apparatus first used for oral still photography was patterned after that suggested in the Leica manual¹ and included a 35 mm. Leica camera with an F-2, 50 mm. lens mounted on a Leitz sliding, focusing copy attachment with a 12 mm. lens extension tube. The camera with copy attachment was mounted on a tripod which in turn rested on the bracket table of the dental unit. Focusing was

¹ MORGAN, W. D., and LESTER, H. M.: *Leica Manual*. 3d edition. Morgan & Lester, New York, N. Y., 1937. p. 419-432.

done through the lens on the ground glass of the copy attachment. The source of illumination was a spotlight containing a No. 1 photoflood bulb, concentrated on the oral cavity. This spotlight was moved about (being free of the photographic apparatus) until the best possible illumination was obtained. The exposure time was determined by use of an exposure meter, and by calculating the decrease in light intensity upon the film that was caused by the intervention of the extension tube and copy attachment between the lens and the film.

This apparatus reduced the size of the field to that of the oral cavity. However, the intensity of illumination varied greatly due to the different positions of the light source necessary to illuminate the area of the oral cavity designated to be photographed. Consequently the color transparencies so obtained were not uniform in quality and density, in contrast with black and white film which permitted such variability.

Another apparatus tested was built by Street, Linder and Probert of Philadelphia. It was a tripod arrangement with a No. 1 photoflood lamp at each end of the triangle in the the same plane. Either an Argus or Leica camera was mounted behind the lamps and shielded by their reflectors. The measuring devices to establish proper focus for close-up and full face photos had to be removed from the lens

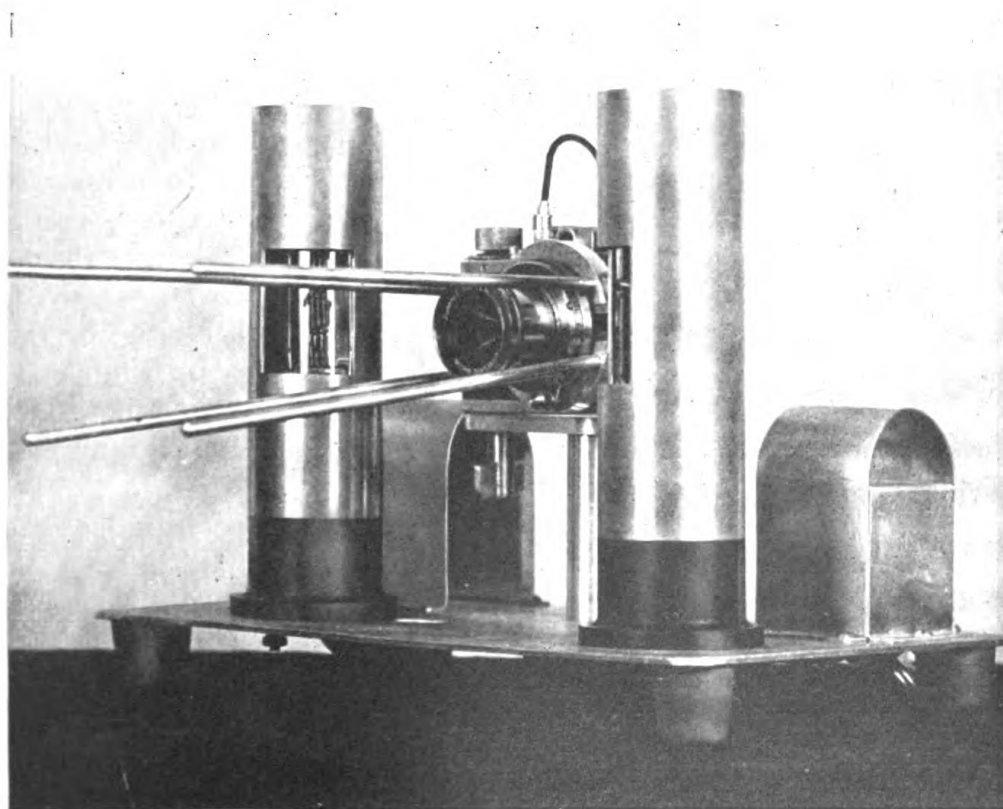


Figure 1.—Front oblique view of photographic apparatus.



Figure 2.—Method of employing photographic apparatus.

before making the exposure. Two lens extension tubes provided either a field including the oral cavity only, or the full face. The time was $\frac{1}{20}$ second for all exposures. A change in the diaphragm opening was used to compensate for the varying intensities of the light reaching the film when one or the other lens extension tube was employed.

The use of this apparatus also required the bracket table of the dental unit or some similar support upon which to rest. The focus was often inaccurate if great care was not exercised. Furthermore, the fixed lateral position of the lamps precluded the proper illumination of the posterior aspects of the oral cavity.

Another type of camera, the Cameron Clinical Camera, also was tried. This camera uses 35 mm. perforated film with a built-in light source, a photo flash bulb and batteries, reflected to the object by a diagonal mirror. A series of interchangeable lenses of various focal lengths permit pictures of different size fields to be made. Focusing is done by means of a reflex housing. The intensity of the illumination of the object is controlled by a cylinder surrounding the flash bulb, the wall of which is perforated by holes of different diameters. The cylinder is easily rotated and the required aperture in this way brought into position over the light source. The lenses have fixed apertures which

may be altered only by fitting an accessory metal lens stop of smaller aperture over the lens, if greater depth of focus is desired.

There were several objections to the use of this apparatus. A blue tinge appeared in the color transparencies, apparently due to improper color quality of the light source. It was necessary to bring the camera rather close to the patient when a field including the oral cavity only was desired. The number of adjustments that had to be made before exposure precluded its use by inexperienced photographers. Its advantages were portability, convenient focusing directly through the lens, built-in light source, and a camera that was one self-contained unit independent of outside electrical energy source.

Modifications of the photographic apparatus described are commercially available but all embody some features which have made their regular use for oral photography unpopular with individuals who were not experienced.

The first oral photographic device which showed promise of being easy to manipulate was that constructed by the Department of Oral Medicine, Dental School, University of Pennsylvania. An adaptation of their apparatus was constructed by the Philadelphia Navy

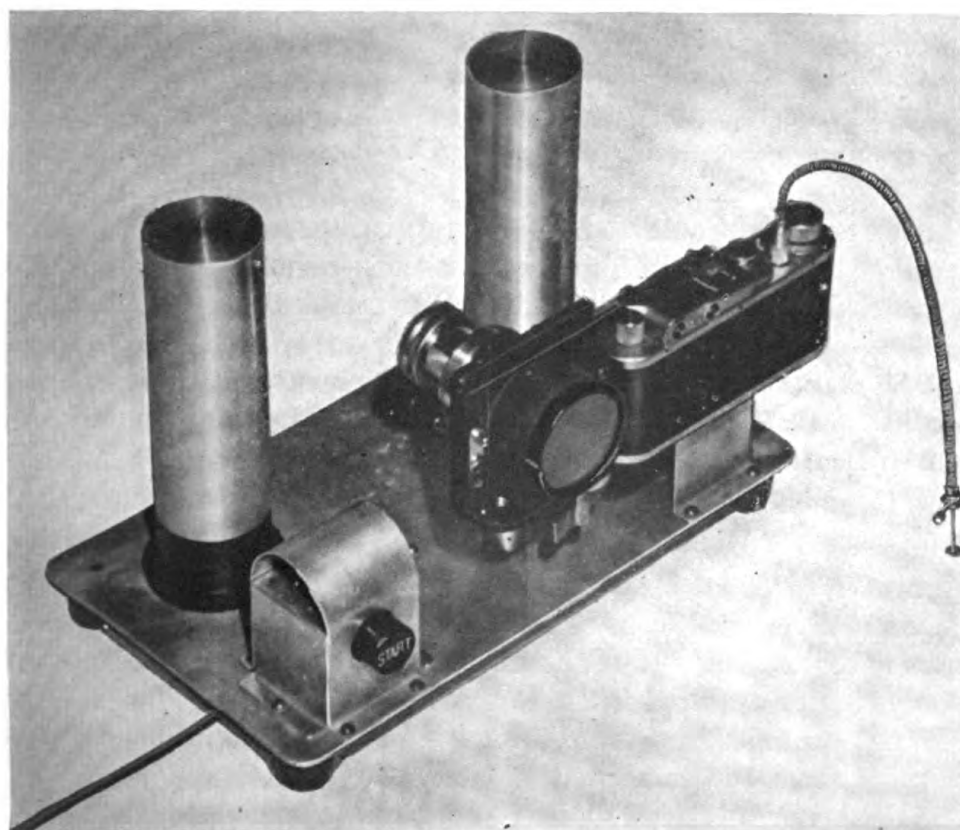


Figure 3.—Rear view of photographic apparatus with sliding focusing copy attachment in place.

Yard and used to make photographs of oral lesions. The resultant transparencies served as controls in a study of oral fusospirochetosis. This apparatus automatically related the light intensity and the distance from object to the lens by a measuring device which did not have to be removed in order to make the exposure. It was portable, in that exposures could be made while holding the apparatus, and thus photographs could be made regardless of the position of the patient. Several models, using the basic principles of the apparatus constructed by the University of Pennsylvania, with variations including refinements and adaptability to different cameras, have been constructed and are in use in Guam, Mariana Islands; Cairo, Egypt; U. S. Naval Dental School, National Naval Medical Center; and the U. S. Naval Medical Research Institute, Bethesda, Md.



Figure 4.—Photograph obtained by using apparatus shown in figure 2.



Figure 5.—Photograph obtained by same means as figure 4.

Because the results obtained with this apparatus have been successful and rather easy to obtain by inexperienced personnel, it was decided that detailed plans for construction and operation of the device should be made available to naval activities. In this way such an apparatus might be constructed in any naval station where a machine shop is available. (Plans may be obtained from the U. S. Naval Medical Research Institute.)

DESIGN AND OPERATION OF EQUIPMENT

Figures 1, 2, and 3 show the assembly and method of operation. Should a more critical focus be desired a sliding focusing copy attachment may be used (fig. 3). If a camera other than a Leica is employed the only change required is the form of attachment of the camera to the stand, provided the camera lens is of 2-inch focal length and removable from the camera.

The light source is two 750-watt Mazda projector lamps with bayonet base. Although these lamps do not give the correct color tempera-



Figure 6.—*Photograph obtained by using apparatus shown in figure 3, using steel mirror.*



Figure 7.—*Photograph obtained by same means as figure 4.*

ture for type A kodachrome color photography, the slightly reddish tint resulting in the transparency is not objectionable. To intensify illumination of an area posteriorly in the oral cavity, the lamps may be moved closer to the principal axis of the lens along the slits in the base of the apparatus. The lamps should not be burned for periods longer than the exposure time. If this precaution is observed, repeated exposure may be made without the lamp house becoming excessively hot.

The ends of the measuring device bound the size of the field exactly and measure the distance at the same time. Photographs of any object, the size of which can be described by the ends of the prongs, may be taken this way. By closing the diaphragm opening to F 12.5, sufficient depth of focus is achieved to include everything from the lips to the uvula in the oral cavity when the mouth is open.

To photograph certain anterior areas of the hard palate and floor of the mouth, a mirror must be used. A metal mirror is preferable since there is only one reflecting surface. In a glass silvered mirror, there is danger of double image formation due to the glass and silvered back reflecting surface. When using a mirror it is necessary to use the focusing copy attachment and to place the apparatus upon some rigid support.

When the copy attachment is used, the lens is pulled out, locked in the barrel and attached to the copy attachment with an intervening 12 mm. lens extension tube which may be readily purchased in any photographic store. Since focusing is done through the ground glass the apparatus must be supported by some solid fixture.

In order to illustrate the use of the oral photographic unit the detailed operation of the device is given below:

1. A 22 mm. lens extension tube is inserted between the 50 mm. Leica lens and the camera.

2. The lens is pulled out, locked in the barrel and set for infinity.
3. The diaphragm is closed to F 12.5.
4. The ends of the four prongs are placed against the face in a position to include the field desired (fig. 2).
5. An exposure of $\frac{1}{40}$ sec. is given for photographs of the lips with mouth closed, or teeth in occlusion and lips parted. One-thirtieth second exposure is made for photographs of the inside of the oral cavity with the mouth open. When using a mirror, an exposure of $\frac{1}{8}$ sec. to $\frac{1}{20}$ sec. is made (all exposures are for line voltages of 115-120 volts).
6. The left thumb pushes the button which lights the lamps and the right thumb trips the shutter via the cable release (fig. 2).

Photographs originally in color showing results which may be obtained utilizing the oral photographic unit as described, appear in figures 4, 5, 6, and 7.

ACKNOWLEDGMENT.—The author is indebted to Mr. J. F. Bronson, Mr. F. I. Whitten, Daniel R. Sullivan, Chief Pharmacist's Mate, USN, and Miles Aborn, Pharmacist's Mate, first class, USN, for their aid in drafting, constructing and illustrating the apparatus described in this article.



BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

TEXTBOOK OF GENERAL SURGERY, by Warren H. Cole, M. D., F. A. C. S., *Professor and Head of the Department of Surgery, University of Illinois College of Medicine* and Robert Elman, M. D., F. A. C. S., *Professor of Clinical Surgery, Washington University School of Medicine*. Fifth Edition, 1160 pages; illustrated. D. Appleton-Century Company, Inc., New York, N. Y., 1948. Price \$11.

This new edition of an excellent teaching textbook has been completely revised and indeed written in the light of the lessons of the war and postwar period which led to many changes and advances in surgery. A new chapter has been added on preoperative and postoperative surgical care. The book, of course, is not an operative manual and the emphasis is on the diagnosis and the proper lines of treatment. The sections dealing with the minor surgical procedures are, however, given in detail.

HISTORY OF MEDICINE, by Cecilia C. Mettler, A. B., Ed. B., A. M., Ph. D., *Late Assistant Professor of Medical History, University of Georgia, School of Medicine, and late Associate in Neurology, College of Physicians and Surgeons, Columbia University*. Edited by Fred A. Mettler, A. M., M. D., Ph. D., *Associate Professor of Anatomy, College of Physicians and Surgeons, Columbia University*. A correlative text, arranged according to subjects. 1215 pages; 16 illustrations. The Blakiston Company, Philadelphia, Pa., publishers, 1947. Price \$8.50.

A new book on the history of medicine, particularly by an American, and by a woman is an event. In our medical schools, medical history has not received the attention it deserves, and this is reflected in the paucity of medical history in this country. Mrs. Mettler, whose un-

timely death in 1943 cut off a most brilliant career, had completed this work only a short time before. Her husband edited the book.

A combination of the biographical and monographic method has been used to advantage to unfold the narrative of ancient and modern medicine. A vast amount of information has been packed into the story though this has in some measure prevented emphasis on more important events. Thus Jenner and smallpox vaccination, one of the greatest of all medical discoveries, receives little more space than the work of Kussmaul, and far less than the space devoted to the errors of Charles Bell as an anatomist. Some other conclusions are open to question but history would be most uninteresting without controversial issues. Medical men would do well to read this book for it is only when we look back can we look ahead. We need more planning for the future based on the lessons of the past in all phases of human activity and never more than at present in the field of medicine.

There is an etched portrait of the author as a frontispiece, which shows the face of a scholar, full of strength and character. One cannot but regret that she did not live to enjoy the prestige and credit she will receive for this fine book, a splendid monument of American historical scholarship.

THE 1946 YEAR BOOK OF ENDOCRINOLOGY, METABOLISM, AND NUTRITION. Endocrinology edited by Willard O. Thompson, M. D., *Clinical Professor of Medicine, University of Illinois College of Medicine; attending Physician (Senior Staff), Henrotin Hospital; Attending Physician, Grant Hospital of Chicago.* Metabolism and Nutrition edited by Tom D. Spies, M. D., *Associate Professor of Medicine, University of Cincinnati School of Medicine; Director, Nutrition Clinic, Hillman Hospital, Birmingham, Alabama.* 573 pages; numerous illustrations. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1947. Price \$3.75.

This is one of the practical annual summaries of great value not only to the general practitioner but to the specialist as well. Of special interest are the reports of nutritional studies on prisoners of war, and Dr. Spies' work on folic acid. This survey of endocrinology is excellent and well illustrated.

DISEASES OF THE SKIN, by James H. Sequeira, M. D. (Lond.), F. R. C. P. (Lond.), F. R. C. S. (Eng.), *Late Councillor of the Royal College of Physicians, London; Consulting Physician to the Skin Department, London Hospital, Consultant to the Military Hospitals in London, 1914-1920 and to the East African Forces, 1942-1944; John T. Ingram, M. D. (Lond.), F. R. C. P. (Lond.), Physician in Charge, Skin Department, The General Infirmary at Leeds; Lecturer in Diseases of the Skin and Clinical Sub-Dean, The Medical School, University of Leeds; Colonel A. M. S. Late Consultant Dermatologist, B. E. F. France, 1939-40; and Reginald T. Brain, M. D. (Lond.), F. R. C. P. (Lond.), Physician in Charge, Skin Departments at the Royal Free Hospital and the Hospital for Sick Children, Great Ormond Street; Lecturer in Diseases of the Skin to the London School of Medicine for Women; Physician to St. John's Hospital for Diseases of the Skin and*

Director of the X-ray and Physiotherapeutic Department; Dermatologist and Lecturer to the British Postgraduate Medical School, University of London. 5th edition. 782 pages; 63 colored plates and 380 text figures. The Macmillan Co., New York, N. Y., publishers, 1947. Price \$15.

The first edition of this work came out in 1911, followed by the second edition in 1915, the third edition in 1918, the fourth edition in 1927, a Spanish translation in 1926, and the present edition in 1947, 20 years after the fourth.

It is a most comprehensive work for a textbook type of publication, exceedingly well written and presented. The text is clear and understandable and makes agreeable, easy reading. The contents and dermatoses are divided into seven separate groups. In each group, the conditions or diseases are described in relation to each other, making it possible for the reader to carry along in his mind and thought, the clinical picture to be recognized in those patients he may see.

The whole work has been revised and many sections have been rewritten and large additions have been made with some alteration in the arrangement and grouping of subjects to bring dermatology into line with general medicine and the needs of the student have not been overlooked.

The illustrations, both plates and text figures, are remarkable in their character, presentation of conditions and lesions in coloring, detail, and case. This feature is so well done that it is quite possible to compare the patient before one with the picture in the book and discover a possible diagnosis.

This book on the subject of dermatology is the best of many the reviewer has seen in several years. It is commended to students and to those practitioners who may desire a reference work for everyday general practice.

THE SELECTED WRITINGS OF BENJAMIN RUSH, edited by Dagobert D. Runes. 433 pages; 2 illustrations. The Philosophical Library, Inc., New York, N. Y., publisher, 1947. Price, \$5.

Rush was a distinguished physician, scientist, and statesman; a signer of the Declaration of Independence and for many years a civic leader in Philadelphia. His courage and devotion to his profession during the great yellow fever epidemic did him honor.

He was a man of most positive character and would have made a poor politician for he never sat on the fence—he was always on one side or the other. His strong convictions are expressed in his writings. These cover a wide field. He was the first writer in Indian medicine and a pioneer in America in opposing capital punishment, dueling, war, and alcoholism.

The author has made excellent selections of the views of Dr. Rush in all these subjects as well as for his medical writings. Many of his

views on both social and medical questions are of value today and well worthy of consideration.

FUNDAMENTALS OF CLINICAL NEUROLOGY, by H. Houston Merritt, M. D., *Professor of Clinical Neurology, College of Physicians and Surgeons, Columbia University*; Fred A. Mettler, M. D., Ph. D., *Associate Professor of Anatomy, College of Physicians and Surgeons, Columbia University*; and Tracy Jackson Putnam, M. D., *Professor of Neurology and Neurological Surgery, College of Physicians and Surgeons, Columbia University*. 289 pages; numerous illustrations. The Blakiston Company, Philadelphia, Pa., publishers, 1947. Price \$6.

Here is a book between a compend and a large textbook intended to give the basic facts on neurology for the general practitioner who often sees neurological cases in his everyday practice. Among excellent features is a plan of examination not too specialized. The common conditions have been emphasized rather than the unusual. The anatomy, pathology, and clinical signs and symptoms have been correlated very well. The interpretations of cerebrospinal fluid findings are outlined. Treatment given is plain and practical and only orthodox methods described. A fine little book.

A HANDBOOK OF COMMONLY USED DRUGS, Including Certain Measures for the Control of Diseases Peculiar to the Tropics of the Western Hemisphere, by Michel PiJoan, B. A., M. D., *Director, The Chemical Foundation Laboratory, University of Colorado, Boulder, Colo.; Formerly Lieutenant Commander, MC (S), USNR, U. S. Naval Medical Research Institute, Bethesda, Md.*, and Clark Harvey Yeager, M. D., Dr. P. H., *Chief of the Medical Section, Health and Sanitation Division Office of Inter-American Affairs, Washington, D. C.; Lecturer on Tropical Diseases, Johns Hopkins Medical School and University of Maryland, School of Medicine, Baltimore, Md.* 198 pages. Charles C Thomas, Springfield, Ill., 1947. Price \$3.75.

This book is essentially a "Tom Thumb" abridgement of "The Pharmacological Basis of Therapeutics," by Goodman and Gilman. As a handy reference, especially where more extensive standard texts are not readily available, it can serve a useful purpose. The authors point out, in fact, that the book represents "the accumulation of notes dealing with drugs, preparations and technics which were useful to the writers, arranged in such a way that it might be conveniently used by others." The pharmacological action of several drugs useful in a given condition and/or conditions is the basis of arrangement. It is a valuable compendium for the medical man on field expeditions or on other isolated duty.

ORAL SURGERY, by Sterling V. Mead, D. D. S., M. S., B. S., *Washington, D. C.* 3d edition. 1450 pages; 805 text illustrations and 16 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$15.

This prominent text needs no introduction. It retains its position as one of the best available references for a thorough and comprehensive study of oral surgery.

The new chapter on chemotherapy is up to date and authoritative in discussing sulfonyl therapy as related to the management of oral pathology. The author stresses the toxic effects of sulfonamide and recommends that "red cell count and white cell count should be repeated every third day during the first week of medication, and after that preferably every day. The longer the drug is used, the more one has to think of agranulocytic reaction." Eight pages are devoted to the use of penicillin in oral surgery and the topic is well covered. However, no mention is made of one of the increasingly popular methods of administering penicillin that lends itself readily to use in oral surgery. The reviewer refers to the single, daily intramuscular injection of 300,000 units of penicillin in beeswax and peanut oil. Recent reports in the literature imply that the sensitivity and sensitization to penicillin may not be as rare as the author states.

Chapter 28, "Fractures of the Maxilla," and chapter 29, "Fractures of the Mandible," have been thoroughly revised to include many treatment appliances that have been developed during the war. A new chapter that helps to satisfy a crying need in an outstanding manner is that devoted to the "correlation of surgery and prosthesis in orofacial deformities." These 20 pages are excellently illustrated and depict the management of practical cases.

The paper and binding used in this revised third edition does not seem to be of the same high quality used for the previously printed second edition.

DIAGNOSIS IN DAILY PRACTICE, by Benjamin V. White, M. D. *Assistant Clinical Professor of Medicine, Yale University School of Medicine; Consultant in Gastroenterology, Veterans' Administration Hospital, Newington, Conn.; Branch Section Chief in Gastroenterology (New England), U. S. Veterans' Administration; Assistant Visiting Physician and Chief of Gastroenterologic Clinic, Hartford Hospital, Hartford, Conn. and Charles F. Geschickter, M. D., Professor of Pathology, Georgetown University Medical School; Consultant in Pathology, U. S. Naval Medical School, Bethesda, Md.; Consultant in Pathology, Mt. Alto Veterans' Administration Hospital, Washington, D. C.; Pathologist-in-chief, Gallinger Municipal Hospital, Washington, D. C.* An office routine based on the incidence of various diseases. 603 pages; 360 illustrations. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1947. Price \$15.

This book has a number of interesting departures, one being the emphasis on incidence as a diagnostic point, something often forgotten, particularly by the inexperienced. Systematic case taking is well outlined. A most useful section is one devoted to normal standards as a basis for abnormal physical findings. Prominent symptoms, such as headache, chest pain or backache, are given considerable space. Skin, neurological and eye signs and symptoms have considerable space, are well illustrated and are often in color.

The book is a refreshing change in general plan in its more graphic type of presentation.

PRACTICAL ANESTHESIA FOR DENTAL AND ORAL SURGERY, Local and General, by Harry M. Seldin, D. D. S., F. I. C. D., F. I. C. A., *Consulting Oral Surgeon, Harlem Hospital, New York City Cancer Institute, and at Peekskill Hospital, Peekskill, N. Y.; formerly Director of the Division of Dentistry, Department of Hospitals, City of New York.* 3d edition. 562 pages; 238 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1947. Price \$8.50.

This third edition of an excellent textbook, thoroughly revised, is perhaps the outstanding current teaching-aid available in the field of local and general anesthesia for dental and oral surgery. The author is a recognized authority in his field and employs many photographs, schematic drawings and diagrams effectively. Perhaps the most notable contents are found in chapter 9, which is on extra-oral block anesthesia of the maxillae and mandible; chapter 21, on armanetarium (for gas anesthesia); and in chapter 22, on the administration of nitrous oxide and its mixtures. The 10 pages devoted to intravenous pentathol sodium anesthesia were somewhat of a disappointment because that type of anesthesia is gaining greater usage in oral surgery. The author gives faint implication that he may consider pentathol sodium as a "passing fancy" when he states, "Although pentothal is the barbiturate most suitable for intravenous anesthesia at the present time, the science of chemistry may develop a superior product in the very near future." The reviewer gained the impression that the author much preferred nitrous oxide-oxygen mixtures over other forms of general anesthetics for dental operation and this impression is borne out by the fact that the greatest bulk of Part II of the book, "General Anesthesia," is devoted to the study of nitrous oxide.

The text is amazingly free of ambiguity of statement and typographical errors. The format is excellent. The author has an enviable style of clarity of presentation, and the book can be read by the undergraduate dental student as well as by the specialist.

PRACTICAL PHYSIOLOGICAL CHEMISTRY, by Philip B. Hawk, Ph. D., *President, Food Research Laboratories, Inc., Long Island City, New York*; Bernard L. Oser, Ph. D., *Director, Food Research Laboratories, Inc., Long Island City, New York*; and William H. Summerson, Ph. D., *Associate Professor of Biochemistry, Cornell University Medical College, New York City, N. Y.* 12th edition. 1323 pages; numerous illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1947. Price \$10.

When a book first published in 1907 reaches a twelfth edition 40 years later, it is close to being a classic in its field. The reason for this is plain. It is a complete and well arranged treatise on physiological chemistry, useful to the teacher, student, research worker, and physician. It is so complete that it constitutes a sort of one volume encyclo-

pedia of the subject. There are many valuable tables, notes and hints in the appendix. The bibliographies at the end of each section while not voluminous are well selected to amplify the subject covered in that part of the book.

Another feature is the clinical and laboratory value of the book which fully justifies the use of the word *practical* in the title. The color plates are another particularly valuable thing. Altogether there is no question but that it will continue to have a wide use.

NURSING CARE IN CHRONIC DISEASES, by Edith L. Marsh, R. N., S. C. M. First edition. 237 pages; illustrated. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1946. Price \$3.

An exceptionally fine book, not only because of its comprehensive text, but because it exudes a sincere concern for the welfare of the chronically ill and the totally and permanently disabled. The science of geriatrics is skillfully explained, and the importance of a knowledge of it in successful treatment of the aged is emphasized.

Types of care available to the chronically ill, advantages and disadvantages of each, available facilities, and ideal environment are well considered, as is the value in their treatment of physical and occupational therapy, therapeutic exercise, and an adequate, well balanced, properly prepared diet.

THERAPEUTIC EXERCISE, by F. H. Ewerhardt, M. D., and Gertrude F. Riddle, B. S., R. N., R. P. T. First edition. 152 pages; illustrated. Lea and Febiger, Philadelphia, Pa., publishers, 1947. Price \$2.50.

An excellent book, instructive and well presented, covering a wide range of diseases and conditions treated by therapeutic exercise. Information is concise and pertinent, and the bibliography well selected and adequate. A satisfactory textbook for occupational and physical therapist, student therapist, and doctor.

Classification of muscular activity, principles for selection of exercise, indications for employment, contra-indications, applications of fundamental movements, precautions, and use of mechanical devices and gravity as resistance to action are carefully related. An excellent chart shows action, origin, and insertion of muscles. The three orders of levers of the body and their relation to muscles, divisions of diarthrodal joints, articulations, and physiology of types of contraction are considered with skill and thorough knowledge. The determination of planes of movement, and current and simplified methods of joint measurement are discussed with ability. The goniometer is described, and readings are fully explained and illustrated.

APPLIED ANATOMY OF THE HEAD AND NECK, by Harry H. Shapiro, D. M. D., *Assistant Professor of Anatomy, College of Physicians and Surgeons, Columbia University*. Second edition, revised and reset. 303 pages; 221 illustrations, with 41 in color. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1941. Price \$10.

The book is devoted to a working description of the human skull, nervous and vascular supply of the tissues of the head and neck. The text is amply illustrated with well selected drawings and photographs with magnify the salient features in each chapter. A chapter on the nose and paranasal sinuses is ably presented to the student of oral surgery. Of particular interest is a section given to the roentgenograms of the skull, and the author's presentation is excellent in the orientation of the complexity of shadows seen in a roentgen film. The anatomic considerations of maxillo-facial injuries and soft tissue involvement is of aid in the visualization of the anatomy involved at any given level or directional path in the maxillo-facial area. The author ties the oral surgeon in with the prosthodontist with his treatment of the anatomy of the edentulous mouth, intermaxillary vertical dimension, and auditory acuity.



PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



FILARIASIS STUDIES IN AMERICAN SAMOA

WILLIAM D. MURRAY
Lieutenant H(S) U. S. N. R.

Filariasis is a disease which is still incompletely understood, although much new knowledge concerning it was acquired during World War II. Our lack of understanding of the disease was brought forcefully to our attention during this war when thousands of troops in the South Pacific contracted filariasis and many of these had to be returned to the United States prematurely. Reports and theories in the literature on this disease are somewhat conflicting, undoubtedly due in some cases to a lack of sufficient data while probably due in others to the fact that in various geographical areas the epidemiology of filariasis may not always be the same.

Byrd, St. Amant, and Bromberg (3) made a study in Samoa of mosquitoes and their role as vectors of the Samoan variety of filaria worm, and they concluded that *Aedes pseudoscutellaris* (Theobald) was probably the only important species in this area. This investigation provided the information necessary for justification of a concerted drive begun in 1945 to reduce the population of *Aedes pseudoscutellaris* to a sufficiently low level that transmission of the filaria would be stopped. However, scientifically sound information on the disease itself and its incidence among the Samoan people was also essential to the proper planning and execution of control measures. Unfortunately, available records for Samoa were of insufficient scope or detail to be of much value to the present control program, therefore a blood smear survey was made in order to obtain the following desired facts.

(a) An accurate record of the index of infection in the different villages in order to provide a guide for the control activities.

(b) A record of each infected individual and where he lived, so that control efforts in each village might be carried out with a specific knowledge of the most important areas. The justification for such

concentrated activity was based on the work of Byrd, St. Amant, and Bromberg who found that an *Aedes pseudoscutellariæ* mosquito infected with the filaria worms probably does not fly more than about 200 yards from the area where it became infected. Thus, military personnel or natives will ordinarily become infected only if they are exposed in or about a native hut where there is an infected person.

(c) An index of infection among the Samoans for comparison with future surveys in order to permit an evaluation of the control work.

In the course of making the blood smear survey and thus obtaining this desired information, certain other facts have been discovered which do not coincide with results of other workers. A review of some of the literature has been made by the writer, and throughout the present report comments will be made wherever the results contained herein differ significantly from those reported by various other authors.

The thick blood smear, treated with giemsa stain, was selected as the most practical method for obtaining an index of the incidence of microfilaremia among the Samoans. Accurate, pipette measurements of the blood smears were not made, in part because the value of accurate worm counts per smear was not fully appreciated earlier, but also because experiment showed that even when identical amounts of blood were taken from the same finger puncture in an individual, the worm counts sometimes differed appreciably. In spite of unavoidable and potentially avoidable inaccuracies in the method used in this survey, it was possible to obtain from the large groups of people examined reliable averages of worm counts and percent of persons infected, as the tables and graphs in this report will attest.

SUMMARY RECORDS OF BLOOD SMEARS IN SAMOAN VILLAGES

In obtaining the records for table 1, the control team made as complete a blood survey as possible in about one-half of the villages in American Samoa, and examined many of the people in the remaining villages when smears were taken from various organizations such as the Fita Fita Guard, the public workers, the school teachers, and various schools. Five thousand one hundred and forty-four Samoans, these being 5 years of age and older, have been examined, and 982, or 19.1 percent of these have had microfilariæ in their blood as determined by the ordinary thick smear method.

It should be understood that persons who are reported negative in the thick smear survey may have great numbers of filaria worms, both adults and larvae, in their body. It is only when the microfilariæ reach a certain density in the blood that they can be readily obtained in a thick smear. There are several methods of concentrating microfilariæ by separating them from much of the blood, but once again a

person who has many microfilariae may be reported negative even after the concentration. It would be necessary to drain all the blood from the body and section all the tissues in order to obtain a sufficiently complete examination to conclude with certainty that a person is negative. To go to such extremes would be obviously absurd, but the point should be made clear that to stop short of this will prevent one from obtaining a definite knowledge of the true percent of positive individuals in a population. However, an approximated 20 cubic millimeter thick smear sample did enable the survey team to obtain an index of the relative incidence of microfilaremia among the people.

Table 1 analyzes the records for each village from the standpoint of percent of persons infected, of worm counts per slide, and of elephantiasis cases. If the filaria rates are dependent upon the density of mosquito populations, specifically of *Aedes pseudoscutellaris*, then some villages should have higher rates than others because favorable breeding sites are much more common and adults are much more abundant in some villages than in others. The question arises as to how filaria rates should be judged. Previous workers have usually considered simply whether a person was positive or negative for worms. Thus, Shattuck (12) stated that population groups in some Pacific Islands may reveal from 48 percent to 80 percent of infected persons. Coggeshall (5) stated that natives showing 60 percent or more having a high concentration of microfilariae in the blood may be found in endemic areas. Saunders (11) stated that in the St. Croix Islands 30.4 percent of the females had microfilariae compared with 21.5 percent of the males. Many other examples could be cited.

The present survey indicates that the percent of positive persons may give a very misleading indication of the filaria situation, as in the following illustration. Members of the Fita Fita Guard spend almost all their time at the naval station where there is probably no transmission of filaria, but a few hours each week may be spent at their individual homes in the native villages. Thirty-two percent of these individuals had positive smears. In a village such as Faleasao the natives spend almost all their time in the hyperendemic area, yet only 17 percent of these persons were positive. Certainly the filaria problem among the natives at Faleasao should be worse than among the Fita Fita Guard, yet if one based his conclusion on the percent of positive individuals alone he would be forced to conclude otherwise. A much better picture is obtained when one considers the worm counts. Thus, the average worm count per slide was only 3.9 for the Fita Fitas as compared with 14.1 for Faleasao natives, and only 2.9 percent of the Fita Fitas had counts of 30 or more worms per slide as compared with 8.8 percent for the Faleasao natives. This and many similar examples which could be cited indicate the value of worm counts in an analysis

of the relative importance of filariasis among different groups of people.

Unfortunately, average worm counts, although they undoubtedly give a better picture than does the percent of positive individuals, may under certain circumstances be misleading. Thus Amouli had an average of 13.2 worms per slide as compared with 12.2 for Fitiuta. In Amouli most of the village was very clean, and a low percent of persons showed microfilariae. Those who were infected, however, lived in small, exceptionally favorable hyperendemic areas and were generally very heavily infected. In Fitiuta the percent of infected persons was considerably higher, and the persons with microfilariae were scattered rather evenly throughout the village. From the standpoint of control, Fitiuta presents a much more difficult problem than Amouli.

Inasmuch as no single factor is always reliable in measuring the seriousness of the filaria situation, a number of different factors were considered and then an average of all was taken. Thus the position of each village among all the villages surveyed was considered for the following factors: percent of persons positive for microfilariae, percent of persons aged 30 and above positive for microfilariae, average worms for all slides, average worms for positive slides, percent of all

TABLE 1.—*Summary records of blood smears in Samoan villages*

No.	Village	Total slides			Total slides from persons aged 30 and over			Number of worms		
		Examined	Positive	Percent	Examined	Positive	Percent	Total	Average of total	Average positive
1	Agugulu.....	27	7	25.9	6	4	66.6	477	17.7	68.1
2	Fagaitua.....	157	35	22.3	55	22	40	2,503	15.9	71.5
3	Aoa.....	149	35	23.5	53	24	45.3	2,702	18.1	77.2
4	Faleniu.....	156	40	25.6	44	22	50	1,955	12.5	48.8
5	Auto.....	31	12	38.7	14	7	50	283	9.1	23.6
6	Alega.....	7	1	14.3	2	1	50	45	6.4	45.0
7	Pava'ia'i.....	141	25	17.7	45	16	35.6	2,520	17.8	100.8
8	Aunu'u.....	118	37	31.4	58	21	36.2	1,307	11.1	35.3
9	Avalo.....	16	2	12.5	5	2	40	444	27.8	222.0
10	Seetaga.....	59	12	20.3	19	8	42.1	526	8.9	43.8
11	Faleasao.....	159	27	17.0	44	13	29.5	2,238	14.1	82.9
12	Fitiuta.....	321	57	17.8	123	41	33.3	3,904	12.2	68.5
13	Alofau.....	111	21	18.9	35	14	40	955	8.6	45.5
14	Onenoe.....	82	15	18.3	30	12	40	1,154	14.1	76.9
15	Amanave.....	118	24	20.3	31	11	35.5	857	7.3	35.7
16	Amouli.....	121	17	14.0	36	10	27.7	1,597	13.2	93.9
17	Amata.....	30	9	23.1	16	7	43.8	187	4.8	20.8
18	Tau.....	487	93	19.1	174	59	33.9	4,251	8.7	45.7
19	Sailele.....	36	10	27.8	14	5	35.7	323	8.9	32.3
20	Laulili.....	161	24	14.9	46	16	34.8	1,388	8.6	57
21	Avasi and Utumea (E.).....	46	8	17.4	16	5	31.3	506	11.0	63.3
22	Nua.....	38	1	2.6	11	1	9.1	233	6.1	21.2
23	Tula.....	137	30	21.9	44	18	40.9	649	4.7	21.6
24	Alao.....	211	43	20.4	64	26	40.6	930	4.4	21.6
25	Failolo.....	45	10	22.2	16	6	37.5	225	5.0	22.5
26	Utumea (w.).....	6	1	16.6	1	1	100	27	4.3	27.0
27	Aua.....	364	71	19.5	104	34	32.7	1,375	3.8	19.4
28	Malaeloa.....	166	23	13.9	53	12	22.6	560	3.4	24.3
29	Pago Pago.....	685	118	17.2	191	70	36.6	2,265	3.3	19.2
30	Lelaloa.....	228	30	13.2	61	18	29.5	823	3.6	27.4
31	Partially surveyed village.....	722	144	19.9	164	71	43.5	3,341	4.6	23.2
Total.....		5,144	982	19.1	1,575	577	36.6	40,550	7.9	41.3

TABLE 1.—*Summary records of blood smears in Samoan villages—Continued*

No.	Village	Slides with 30 or more worms			Cases of elephantiasis observed	
		Number	Percent of total	Percent positive	Number observed	Percent of persons aged 30 or older
1	Agugulu.....	5	18.5	71.4	1	16.6
2	Fagaitua.....	21	13.4	60.	5	9.1
3	Aoa.....	12	8.1	34.3	8	15.1
4	Falenlu.....	23	14.7	57.5	1	2.3
5	Auto.....	4	12.9	33.3	2	14.3
6	Alaga.....	1	14.3	100.	1	50
7	Pava'ia'i.....	15	10.6	60	2	4.4
8	Aunuu.....	16	13.6	43.2	2	3.4
9	Avalo.....	2	12.5	100	—	—
10	Seetaga.....	5	8.5	41.7	2	10.5
11	Faleasao.....	14	8.8	51.9	4	9.1
12	Fitiuta.....	27	8.4	47.4	12	9.8
13	Alofau.....	10	9	47.6	1	2.1
14	Onenoe.....	4	4.9	26.7	1	3.3
15	Amanave.....	9	7.6	37.5	3	9.7
16	Amouli.....	9	7.4	52.9	1	2.8
17	Amata.....	3	7.7	33.3	1	6.3
18	Tau.....	38	7.8	40.9	3	1.7
19	Sallele.....	1	2.8	10	1	7.1
20	Laulili.....	11	6.8	45.8	—	—
21	Auasi and Utumoe (E.).....	3	6.5	37.5	—	—
22	Nua.....	1	2.6	100	—	—
23	Tula.....	6	4.4	20	1	2.3
24	Alao.....	9	4.3	20.9	2	3.1
25	Failolo.....	2	4.4	20	—	—
26	Utumoe (W.).....	—	—	—	—	—
27	Aua.....	11	3	15.5	4	3.8
28	Malaeloa.....	5	3	21.7	4	7.6
29	Pago Pago.....	21	3.1	17.8	4	2.1
30	Leloaia.....	6	2.6	20	—	—
31	Partially surveyed village.....	33	4.5	22.9	—	—
Total.....		327	6.4	33.3	66	4.2

slides with 30 or more worms, percent of positive slides with 30 or more worms, and elephantiasis rate. The village averaging highest for all these items was placed first in table 1, and so on. Whether the various factors have been properly weighed is open to question, but at least the final rating of the villages usually places them pretty close to where they might be expected to be on the basis of the mosquito surveys.

EFFECT OF AGE ON INCIDENCE OF MICROFILAREMIA

Napier (9) stated that there is no reason to believe that age makes any difference in the susceptibility of man to infection or in the number of microfilariae that will circulate. O'Connor and Hulse (10) reported that in Puerto Rico there is a rise in microfilarial incidence from the age of 6 until the peak is reached in the second decade, and that a distinct falling off in incidence occurs in and after the fourth decade. Hughes (6) reported that in the Virgin Islands the peak of infection was reached about the age of puberty. Buxton (2) reported that in British Samoa there is no constant rise or fall in the number of microfilariae per positive slide from 11 years of age upwards.

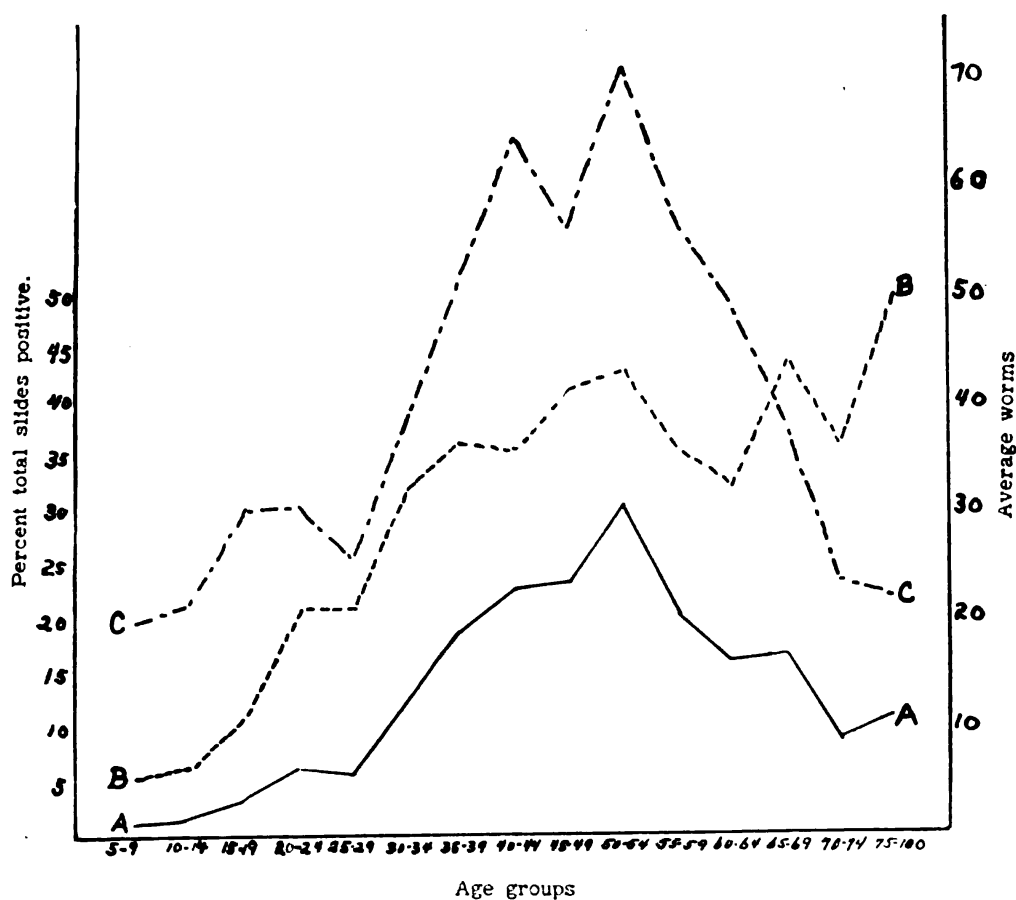
Belding (1), quoting various sources, admitted that the incidence of infection varied with age, but believed that these variations were due to environmental factors rather than to individual immunity.

Table 2 and figure 1 present the findings of the present survey on the relationship of age to incidence of microfilaremia. Age groups of 5 years have been selected as workable. In the lower age groups the Samoans give their age within 1 or 2 years of their actual age, but in the upper age groups they frequently guess only within 5 or 10 years. Fortunately the figures average up well and produce a remarkably smooth graph. No smears were taken on children less than 5, but it seems probable that a few positive slides would be found in children 4, 3, and perhaps 2 years of age. Figure 1 cannot show the complete picture on age and microfilaria relationships because, for simplicity, sex is not considered at this point. Part IV of this report considers the relationship of sex to the incidence of microfilaremia.

It was indicated in part II of this report that average worm counts give a better picture of the filaria situation than does the percent of positive individuals. It is believed, therefore, that the graphs for average worm counts are better than that for the percent of positive individuals.

The graphs on figure 1 demonstrate beyond doubt that there is a relationship between age and incidence of microfilaremia in American Samoa. From graphs *A*, *B*, and *C* one might conclude the following: there is a more or less regular increase in the amount of microfilaremia in the population up to the 50-54 age group. Graph *B* is difficult to analyze for ages above 50-54, but graphs *A* and *C* show a rather steady drop in microfilaremia from this point to the upper age limit, this drop being of approximately the same magnitude as the corresponding rise below ages 50-54. The irregularity caused by the 75-100 age group is probably due to the small number of persons examined and the consequent poor sampling.

Microfilariae could not appear very early in life because the time required for the worms to mature, mate, and commence discharging larvae would be from 6 or 8 months up to 1 year, and several more years might be necessary for adult and larval populations to build up in the body. Microfilariae were never found in American troops during their first year on filarious islands, and very rarely during the second year. Since few troops remained in a hyperendemic area for more than 2 years, observations during succeeding years could not be made. After constant exposure to infected mosquitoes for 2 or 3 years, any differences in microfilaria rate should be due to differences in immunity. The shape of the three graphs on figure 1 appears to be determined not by environment, but rather by the varying immunities of persons of the different age groups. The subject of immunity will be discussed further later in this paper.



A ——— Average worms for total slides. B-----Percent total slides positive.
C ----- Average worms for positive slides..

Figure 1.—Age and incidence of microfilaremia.

TABLE 2.—Age and incidence of microfilaremia

	Age groups														
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-100
Total slides examined.....	714	968	851	552	484	418	328	206	221	142	85	89	43	19	24
Total slides positive.....	37	61	93	114	100	135	120	73	91	61	30	29	19	7	12
Percent total slides positive.....	5.2	6.3	10.9	20.7	20.7	32.3	36.6	35.4	41.2	43.0	35.3	32.6	44.2	36.8	50.0
Total worms.....	720	1,307	2,786	3,445	2,546	5,174	6,150	4,704	5,087	4,358	1,706	1,414	723	164	266
Average worms for total slides.....	1.0	1.4	3.3	6.2	5.3	12.4	18.8	22.8	23.0	30.7	20.1	15.9	16.8	8.6	11.1
Average worms for positive slides.....	19.5	21.4	30.0	30.2	25.5	38.3	51.3	64.4	55.9	71.4	56.9	48.8	38.1	23.4	22.2

EFFECT OF SEX ON INCIDENCE OF MICROFILAREMIA

Causey et al. (4) found little difference in the incidence rate of filariasis among males and females in Brazil. Napier (9) stated that in India there was no reason to believe that sex made any difference in the number of microfilariae that will circulate. Saunders (11) found

that in the St. Croix Islands 30.4 percent of all females had microfilariae to only 21.5 percent of the males. O'Connor and Hulse (10) found little difference in the sex incidence of microfilariae in Puerto Rico. Maxwell (7) stated that in China the females were not so subject to infection as were the males, and he gave as a possible explanation the wearing of more clothing by the female.

Table 3 and figures 2, 3, and 4 present the records of the present survey on the relation of sex to the incidence of microfilaremia. Since the study of the average worms for all slides examined has given the most consistent results, figure 3 is believed to present the best picture of the relationship of sex to microfilaremia, although figures 2 and 4 show somewhat similar pictures.

These figures show that until about the age of puberty there is little difference in incidence of microfilaremia between males and females, but from then on the rates in the two sexes diverge, the males being far more subject to the condition than the females. The incidence in the females does continue to increase gradually from puberty to about 40 or 45, but to a much less extent than in the males.

The explanation of the differences between males and females appears to lie in differences in immunity. Clothing could be of no importance in explaining the differences in Samoa, because males and females dress practically alike. It might be suggested that differences in occupation, with consequent differences in exposure to mosquito bites, could account for the differences, but epidemiological studies in Samoa appear to deny this, although it must be admitted that there is need for more research on this matter. Byrd, St. Amant, and Bromberg (3) found that mosquitoes collected in the center of a village had a much higher infection rate than mosquitoes collected on the edge of a village, and mosquitoes 100 yards or more from the edge of a village were rarely infected. Actual mosquito populations may be very great about an isolated trash dump or in a run-down coconut grove, but mosquitoes collected in these sites by Byrd et al. were apparently never found infected, and the present control team found none of these mosquitoes infected in several checks. It would seem, therefore, that the mosquitoes in the villages, and especially in the huts themselves, are the only ones important as vectors. Since men spend much of their time away from the village fishing or gardening, while women remain in the village practically all the time, it is apparent that the women are more exposed to bites of infected mosquitoes than are the men.

One of the most striking types of surveys, and one which substantiates these conclusions, was made on several occasions in hyperendemic areas in native huts at meal time when large groups were gathered together. Mosquitoes were collected on all persons in con-

siderable numbers, with little obvious selection of person by mosquito. Subsequent examination of these mosquitoes revealed that about one-fifth of them had filaria worms in their bodies. When a blood smear survey was made of all the persons, the incidence of microfilaremia ran about as shown for Samoans in general. In the huts all persons must have received approximately an equal number of bites from infected mosquitoes and should have had approximately equal numbers of filaria inoculated into them, yet the young children, old persons and females were lightly infected while the young and middle-aged men were heavily infected.

In view of the preceding comments, there is little doubt but that the lower rate of microfilaremia in women as compared with men is due to a greater immunity on the part of the female. In the present case this is immunity specifically to the appearance of microfilariae in the blood. However, females are also much less likely to have elephantiasis than are men, as will be shown later in this paper, and records from the Samoan hospital showed many more cases of deep

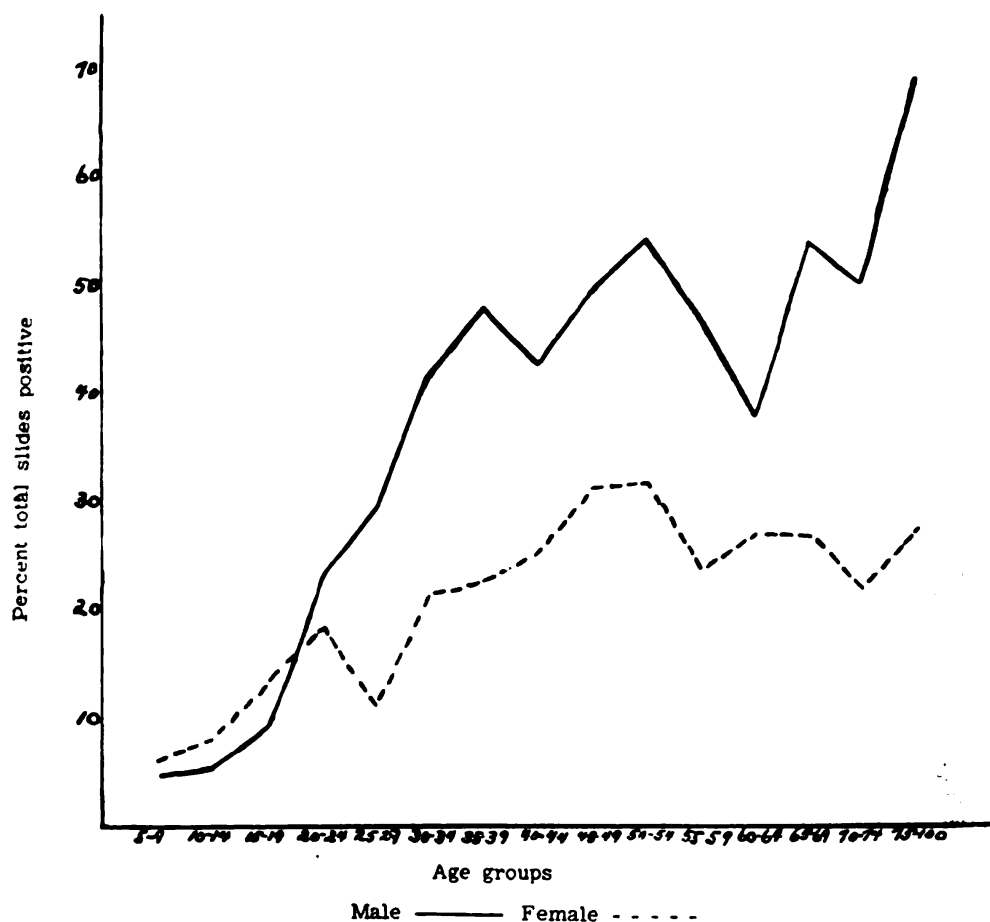


Figure 2.—Sex and incidence of microfilaremia. Percent of total slides positive.

775069°-48-13

filaria abscesses among males than among females. Also, general questioning of the Samoan people indicated that they believed that men had more attacks of typical "mumu" than women. It would seem, therefore, that women are more resistant to all stages of filariasis and its complications than are men. This is not an unexpected conclusion, since there are many human diseases in which the man is more susceptible than the woman.

Wharton (15) stated that there are persons immune to filariasis, and he found that the lymph nodes constituted one site where many microfilariae were destroyed. Michael (8) stated that the immune reactions of the host, together with the reticulo-endothelial barrier in his lymphatic system, are probably sufficient to destroy and engulf the parasite in most instances, provided constant reinfection is not occurring. None of these recent papers offer an explanation of how age and sex might influence immunity.

TABLE 3.—*Sex and incidence of microflaemia*

Age group and sex	Total slides examined	Total slides positive	Percent total slides positive	Total worms	Average worms for total slides	Average worms for positive slides
5-9 years:						
Male.....	363	16	4.4	268	0.7	16.8
Female.....	351	21	6.0	452	1.3	21.5
10-14 years:						
Male.....	534	27	5.1	661	1.2	24.5
Female.....	434	34	7.8	646	1.5	19.0
15-19 years:						
Male.....	441	39	8.8	1,682	3.8	43.1
Female.....	410	54	13.2	1,104	2.7	20.4
20-24 years:						
Male.....	309	70	22.7	2,388	7.7	34.1
Female.....	243	44	18.1	1,057	4.3	24.0
25-29 years:						
Male.....	241	71	29.5	1,741	7.2	24.5
Female.....	243	29	11.1	805	3.3	27.8
30-34 years:						
Male.....	232	96	41.4	4,269	18.4	44.5
Female.....	186	39	21.0	905	4.8	23.2
35-39 years:						
Male.....	185	88	47.6	4,575	24.7	52.0
Female.....	143	32	22.4	1,575	11.0	49.2
40-44 years:						
Male.....	122	52	42.6	3,538	29.0	68.0
Female.....	84	21	25.0	1,166	13.9	55.5
45-49 years:						
Male.....	121	60	49.6	3,812	31.5	63.5
Female.....	100	31	31.0	1,275	12.8	41.4
50-54 years:						
Male.....	72	39	54.2	3,515	48.8	90.1
Female.....	70	22	31.4	843	12.0	38.3
55-59 years:						
Male.....	47	21	46.8	1,207	25.7	57.5
Female.....	38	9	23.7	499	13.1	55.4
60-64 years:						
Male.....	48	18	37.5	1,210	25.2	67.2
Female.....	41	11	26.8	204	5.0	18.5
65-69 years:						
Male.....	28	15	53.6	672	24.0	44.8
Female.....	15	4	26.7	51	3.4	12.8
70-74 years:						
Male.....	10	5	50.0	158	14.8	29.6
Female.....	9	2	22.2	16	1.8	8.0
75-100 years:						
Male.....	13	9	69.2	216	16.6	24.0
Female.....	11	3	27.2	50	4.5	16.6

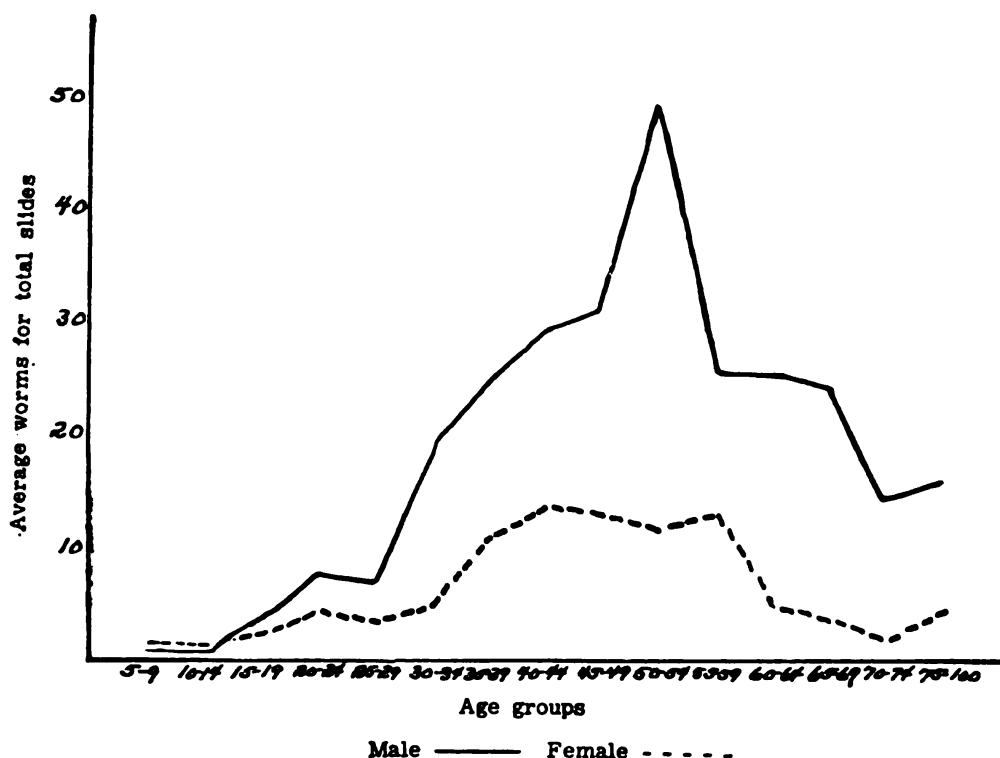


Figure 3.—Sex and incidence of microfilaremia. Average worms for total slides.

ELEPHANTIASIS RATES

An incidental check was made of persons with obvious manifestations of elephantiasis. The disease was not observed in any person less than 30 years of age. Sixty-six, or 4.2 percent of the 1,575 persons 30 years of age or older on whom a blood smear was taken had elephantiasis. If hidden parts such as the scrotum had been examined, the rate would have been considerably higher.

Causey et al. (4) in Brazil found that there was a much higher incidence of elephantiasis in the adult female than in the male. Coggeshall (5) stated that elephantiasis appeared late in life and rarely involved more than 5 percent of the population, even in the most highly endemic areas.

Table 4 and figure 5 show the results of the present survey on the relation of age to the incidence of elephantiasis. Inasmuch as the total number of persons with elephantiasis was too small to allow for ideal sampling, the records are prepared in such a way as to consider all persons of a given age group and above, rather than a single age group alone.

Males have a much higher rate than females, even when the scrotum is never considered. While elephantiasis does not involve as much as 5 percent of the total population, it can be readily seen that, when one

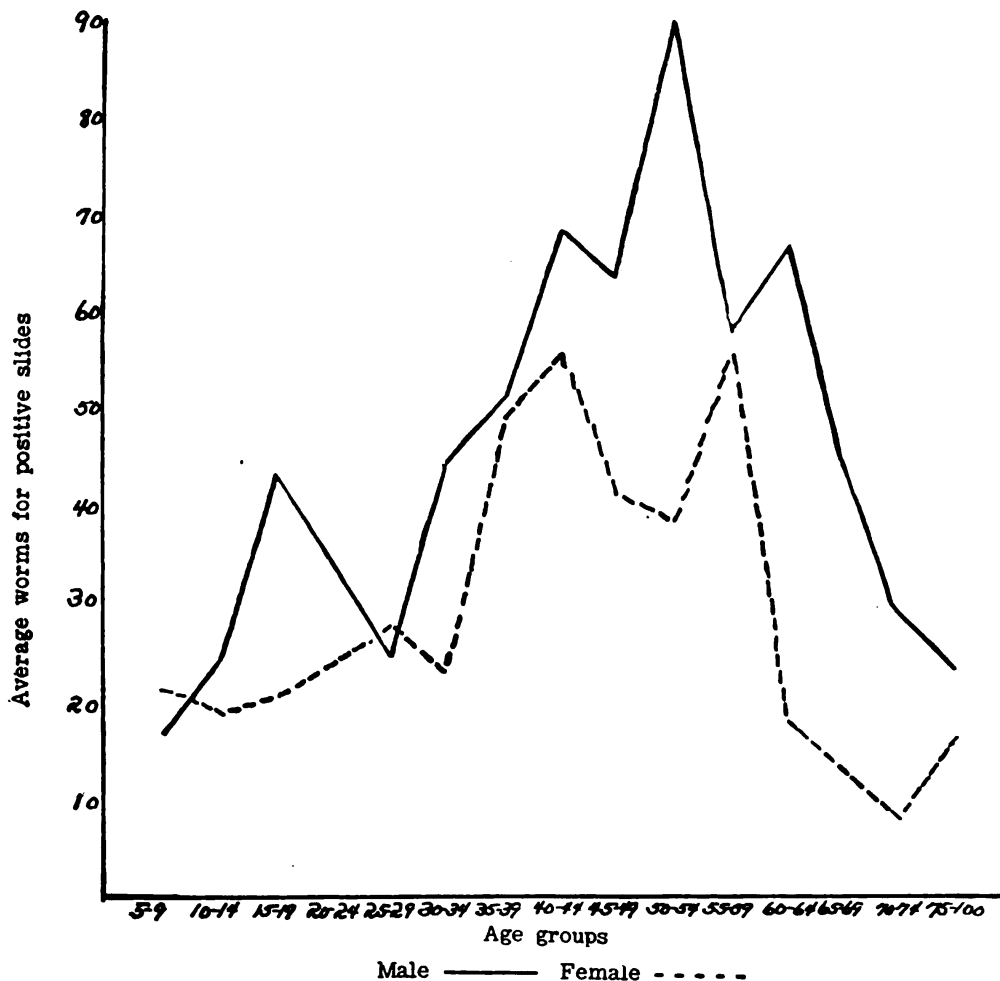


Figure 4.—Sex and incidence of microfilaremia. Average worms for positive slides.

considers only males aged 50 or older, almost one out of every six has enlarged arms or legs. That could not present a very happy future for the aging male. If the scrotum had also been considered, the future would be even less attractive. Stuart et al. (14) said "We do not see the very large elephantoid scrotum, said to have been common 20 or 30 years ago, but surgery has changed that picture." The writer has seen scrota with 3 or 4 large incisions indicating that number of operations to reduce the size, and these individuals were in the hospital for still further treatment.

ELEPHANTIASIS AND MICROFILAREMIA

Stitt and Strong's (13) text on tropical diseases states that persons with elephantiasis usually do not have circulating microfilariae. Napier (9), quoting Rao, stated that in India microfilariae were found in 8.4 percent of those with elephantiasis against 54.3 percent in those without it. He also quoted Iyengar, who found that microfilariae

were three times as great among those with no clinical symptoms. Saunders (11) found that in the St. Croix Islands elephantiasis was more frequent among persons who do not show microfilariae in their blood. Stuart et al. (14) found that in American Samoa, of persons with elephantiasis, 50 percent of the women and 51 percent of the men were positive for microfilariae, while of persons without elephantiasis, 62 percent of the women and 64 percent of the men were positive.

TABLE 4.—*Age and incidence of elephantiasis*

Age group and sex	Total persons of corresponding age group and above	Total cases for corresponding age group and above	Persons of corresponding age group and above with elephantiasis	Age group and sex	Total persons of corresponding age group and above	Total cases for corresponding age group and above	Persons of corresponding age group and above with elephantiasis
30-34 years:			Percent	55-59 years:			Percent
Male.....	878	51	5.8	Male.....	146	25	17.1
Female.....	697	15	2.1	Female.....	114	4	3.5
35-39 years:				60-64 years:			
Male.....	646	47	7.3	Male.....	99	17	17.2
Female.....	511	13	2.5	Female.....	76	3	3.9
40-44 years:				65-69 years:			
Male.....	461	44	9.5	Male.....	51	11	21.6
Female.....	368	10	2.7	Female.....	35	2	5.7
45-49 years:				70-74 years:			
Male.....	339	41	12.1	Male.....	23	3	13.0
Female.....	284	8	2.8	Female.....	20	2	10.0
50-54 years:				75-100 years:			
Male.....	218	33	15.1	Male.....	13	2	15.4
Female.....	184	7	3.8	Female.....	11	1	9.1

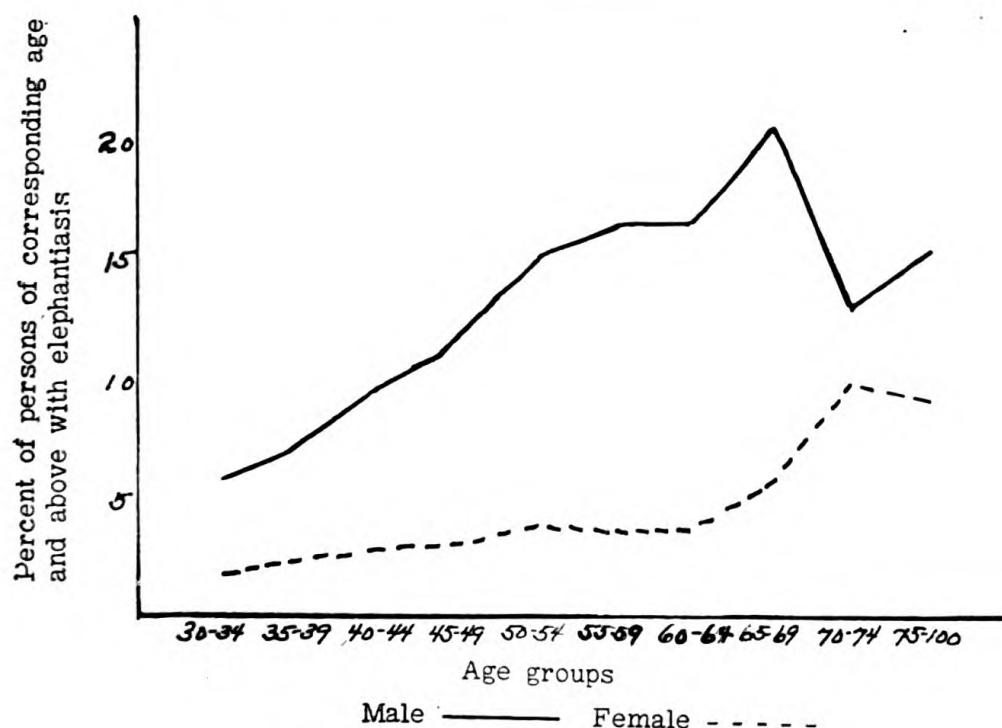
Figure 5.—*Age, sex, and incidence of elephantiasis.*

Table 5 presents the records of the present survey. Of the 66 individuals with obvious elephantiasis from whom blood smears were taken, 32, or 48.5 percent were positive for microfilariae. Since only 577, or 36.6 percent of the total of 1,573 persons 30 years of age and above showed microfilariae, it can be seen that in American Samoa persons with elephantiasis are much more likely to have microfilariae than persons without this condition. The figure of 48.5 percent is approximately the highest that was obtained for any age group when males and females are considered together. The figure of 37.4 for the average worms per slide is considerably higher than that obtained for any age group when males and females are considered together. This same trend is shown when males are considered separately, but in the case of the females too few females with elephantiasis were found to allow for good sampling. It will be noted that the present results are in sharp contrast with those from other parts of the world and even with previous studies from Samoa.

TABLE 5.—*Elephantiasis and microfilaremia*

	Records for all slides	Records for persons with elephantiasis	Records for all slides		Records for persons with elephantiasis	
			♂	♀	♂	♀
Total slides.....	1,575	66	878	697	51	15
Total slides positive.....	577	32	403	174	29	3
Percent total slides positive.....	36.6	48.4	45.9	25.0	56.9	20.0
Total worms.....	29,746	2,470	23,162	6,584	2,410	50
Average worms for total slides.....	18.9	37.4	26.4	9.4	47.3	3.3

SUMMARY

1. In order to obtain certain information of value in planning filaria control on Samoa, a blood smear survey which included 5,144 Samoans 5 years of age and older was made. 19.1 percent of these were positive for microfilariae.

2. Average worm counts per slide gave a better index of the filaria situation than did the percent of positive individuals.

3. There is an increase in the amount of microfilaremia in the population from the age group 5-9 up to 50-54, after which there is a steady drop to the upper age limit.

4. Until the age of puberty there is little difference in incidence of microfilaremia between males and females, but from that period on the rate in the two sexes diverges, males being far more subject to the condition than females.

5. The incidence of elephantiasis increases steadily as the age increases. Males have a much higher rate of this disease than females, even when the scrotum is not considered.

6. Samoans with elephantiasis had a considerably higher rate of microfilaremia than did Samoans without elephantiasis, when comparable age and sex groups were considered.

REFERENCES

1. BELDING, D. L.: Textbook of Clinical Parasitology. D. Appleton-Century Company, Inc., New York, N. Y., 1942.
2. BUXTON, P. A., and HOPKINS, G. H. E.: Researches in Polynesia and Melanesia; Parts I-IV. London School of Hygiene and Tropical Medicine, London, England, 1927.
3. BYRD, E. E.; ST. AMANT, L. S.; and ~~BLOM~~^{BLOM}BERG, L.: Studies on filariasis in Samoan Area. U. S. Nav. M. Bull. 44: 1-20, Jan. 1945.
4. CAUSEY, O. R.; DEANE, M. P.; da COSTA, O.; and DEANE, L. M.: Studies on incidence and transmission of filaria, *Wuchereria bancrofti*, in Belem, Brazil. Am. J. Hyg. 41: 143-149, Mar. 1945.
5. COGGESHALL, L. T.: Problems of filariasis. South. M. J. 38: 186-189, Mar. 1945.
6. HUGHES, H. V.: Filariasis. Report on 1,742 persons observed in St. Croix, Virgin Islands. U. S. Nav. M. Bull. 25: 111-117, Jan. 1927.
7. MAXWELL, J. P.: Filariasis in China. Philippine J. Sc. 19: 257-323, Sept. 1921.
8. MICHAEL, PAUL: Filariasis. Histopathologic study. U. S. Nav. M. Bull. 45: 225-236, Aug. 1945.
9. NAPIER, L. E.: Filariasis due to *Wuchereria bancrofti*. Medicine. 23: 149-179, May 1944.
10. O'CONNOR, F. W., and HULSE, C. R.: Studies in filariasis in Puerto Rico. Puerto Rico J. Pub. Health & Trop. Med. 11: 167-272, Dec. 1935.
11. SAUNDERS, G. M.: Comparison of incidence of filariasis (*Wuchereria bancrofti*) in islands of St. Thomas and St. Croix. Am. J. Trop. Med. 21: 481-485, May 1941.
12. SHATTUCK, G. G.: Bancroftian filariasis and elephantiasis. M. Clin. North America 27: 862-869, May 1943.
13. STRONG, R. P. (editor): Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases, Vol. 2. 6th edition. The Blakiston Company. Philadelphia, Pa. 1942. pp. 1294-1339.
14. STUART, M. A., et al.: Experimental treatment of filariasis with intramuscular injections of oil of chenopodium. U. S. Nav. M. Bull. 28: 459-487, Apr. 1930.
15. WHARTON, D. R. A.: Review of recent findings in filariasis. New York State J. Med. 45: 500-504, Mar. 1, 1945.



GASTRO-ENTERITIS OUTBREAK DUE TO POWDERED MILK

ROBERT W. BABIONE

Captain (MC) U. S. N.

Food poisoning outbreaks of various types continue to occur. With demobilization, the medical officer is faced with an increased need for closer supervision of galley procedures because of the loss of experienced personnel. The outbreak here reported calls attention to another possible source of trouble which may be more easily missed by the medical officer and the commissary officer because the food in question is often prepared at midnight and eaten at crew's breakfast, as it was in this instance.

At least 308 persons became ill 7 to 22 hours after a breakfast eaten aboard a large transport. The onset was abrupt and violent but the duration was not long. At least half of the cases were put to bed, but all had returned to duty by the following morning. A few (5 percent) had diarrhea and mild abdominal cramps for as long as 3 days. Many received ambulatory treatment only, and some did not even report to the sick bay.

The main symptoms in severe cases were:

1. Strong burning pain in the epigastric area.
2. Repeated vomiting.
3. Severe abdominal cramps.
4. Watery, nonbloody diarrhea.
5. Chills and fever.
6. Dehydration.

Treatment consisted of fluids as tolerated, bed rest, bismuth and paregoric, and for more severe cases morphine and atropine and intravenous fluids.

(Where diarrhea is pronounced, alkalis may be included with fluids by mouth. Cathartics are not indicated, once diarrhea has set in.)

EPIDEMIOLOGY

Since the cases occurred simultaneously on board ship and at a receiving station which had received a draft from the ship during the forenoon and since cases in both places were limited to men who had eaten breakfast aboard ship, the offending meal was easily identified. The cases were limited to those persons who ate from the enlisted men's mess. The only officer affected was the Officer of the Day who sampled the enlisted men's food. This distribution should rule out ship's drinking water. A questionnaire showed that milk was the only food item taken by all who became ill. Some men had drunk milk without becoming ill.

In most food poisoning outbreaks some individuals who ingest the suspected food show no symptoms. This may be because of unequal inoculation or incubation of the food or unequal reheating of certain portions of the food (ham, hash, creamed eggs are common examples). A relative immunity greater in some individuals than in others also doubtless plays a role. It is not always easy by questionnaire to identify the suspected food, but a finding that some who ate the food were not made ill by it should not be taken as evidence for excluding a suspected food.

For control purposes galley crews were inspected and given additional instructions. Those with diarrhea were excluded from galley duty. The latter precaution, especially valuable in dysentery outbreaks, is also important in bacillary food poisoning, but of very little importance in the staphylococcus toxin type of outbreak. In order to institute proper control measures, the type of outbreak should be known. As no bacteriological facilities were available, the causative organism was not determined.

For epidemiological purposes, most diarrheal outbreaks can be broadly differentiated, if the incubation period is known, into 4 types, staphylococcus enterotoxin, salmonella and shigella infections, and chemical poisonings. Outbreaks can safely be said to be due to staphylococcus (occasionally streptococcus) enterotoxin, if all the cases appear within 1 to 6 hours after the offending food is eaten. The quantity of enterotoxin ingested affects the course, larger quantities producing earlier and more severe symptoms and signs. Prostration may be very marked but recovery is the rule within 6 to 24 hours. If all the cases have their onset from 6 to 24 hours after the infected food is eaten, bacillary food infection with one of the many species of salmonella (paratyphoidlike) bacilli, or one of the somewhat similar proteus or paracolon organisms is the almost certain cause. Fever is more often present, and some of the cases last more than 1 day. If the onset is later and more scattered, with prolonged fever and extended course, one of the shigella (dysentery group of organisms) should be suspected. It is possible and very confusing to have a simple outbreak with more than one cause involved. The metallic poisons, cadmium or zinc, cause violent gastric and upper intestinal irritation within one-half to 2 hours of their consumption. The source of these poisons is usually the cadmium-plated outer shell of food carts, or GI cans. It is only when acid foods, such as lemonade, jello, or tomatoes, stand in these containers for a period of time that significant quantities of metallic poison are dissolved into the food. Occasionally virus enteritis may spread through a ship or station, with case distribution similar to that of the common cold.

PREVENTION

Bacterial food infection (salmonella) or intoxication (staphylococcus enterotoxin) never occurs without several hours incubation at warm temperature following the seeding of suitable food with bacteria. In the present instance, it is reported that the powdered milk was prepared in the usual way, placed in clean cans and placed in the ice box, but that sufficient time elapsed at tropical temperature prior to serving to allow bacterial growth. Medical officers and commissary officers must check on the following points in handling of milk powder:

1. The mixing vessels and utensils must be clean and free of pathogenic bacteria. Pans are sometimes set on the deck, then set inside one another, thus contaminating the pans. Polluted harbor water is sometimes used to wash down galley decks, with hoses connected to faucets on the salt water lines. Thus pans may become inoculated with fecal bacteria.

2. Wooden paddles are never sterile, and if contaminated while being used to stir up milk powder, they may inoculate a large amount of milk.

3. Stirring by means of spoons, ladles with short handles, etc., leads to dipping of hands into the milk, thus introducing fecal or staphylococcal organisms. The general rules for personal cleanliness must be indoctrinated and enforced, facilities for washing the hands should be convenient, and long handled metal stirring rods or paddles should be furnished.

4. Milk powder is often added to hot water to speed dissolving. This mixture while cooling, remains at temperatures favorable to bacterial growth for a long time before it is sufficiently cooled. Pouring into large cans, and placing in crowded or too-warm refrigerators further prolongs the period that the milk remains at a temperature permitting bacterial growth. Milk powder should be mixed with cold water and refrigerated immediately.

After being removed from the refrigerator, several hours at room temperature in the Tropics will favor multiplication of bacteria to numbers sufficient to cause food poisoning if the proper bacteria are present.

The precautions listed above apply with equal force to the mechanical cow and ice cream machines where these are in use, with the provision that the more complicated machinery requires greater skill and care for thorough cleansing and adequate sterilization. Each part must be disassembled to the extent necessary for complete cleansing. After a complete cleaning with soap and water, all parts that are in contact with food must be rinsed with disinfectant solution and finally with scalding water.

CONCLUSION

Milk is a good medium for growth and spread of streptococci and other pathogens, as well as both types of food poisoning organisms. Careful indoctrination and strict supervision of all men engaged in reconstituting milk and milk products is essential for the prevention of outbreaks of food poisoning and other potentially milk-borne epidemic diseases.



NOTES ON CONTRIBUTORS



Abrams, Robert C., Commander (MC) USNR (Inactive) (*Salmonella Osteomyelitis*, p. 306). A. B., Johns Hopkins University, 1935; M. D., Johns Hopkins University School of Medicine, 1939. Intern, Johns Hopkins Hospital, Baltimore, Md., 1939-40; intern and assistant resident surgeon, Union Memorial Hospital, Baltimore, Md., 1940-41. Appointed assistant surgeon, USNR, 24 Sept. 1941 from Maryland; transferred to Regular Navy 25 Jan. 1942; resigned 16 May 1947; appointed Commander (MC) USNR (inactive) 10 Nov. 1947. Served at U. S. Fleet Hospital No. 110 and at U. S. Naval Hospital, Oakland, Calif. Resident, orthopedic surgery, Michael Reese Hospital, Chicago, Ill., Jan. 1948-.

Adams, Jesse F., Lieutenant (MC) USN (*Treatment of Acute Sacrococcygeal Cyst Teratoma*, p. 250). M. D., University of Tennessee College of Medicine, 1943. Appointed ensign, H-V(P). USNR, 12 June 1942; classification changed to acting assistant surgeon, USN, 22 April 1943. Intern, U. S. Naval Hospital, Portsmouth, Va.; duty under instruction, U. S. Naval Hospital, Bremerton, Wash.; resident in orthopedic surgery, U. S. Naval Hospital, St. Albans, Long Island, New York.

Babione, Robert W., Captain (MC) USN (*Gastro-enteritis Outbreak Due to Powdered Milk*, p. 342). A. B., Oberlin College, 1924; M. D., Western Reserve University School of Medicine, 1930. Appointed assistant surgeon, USN, 3 June 1930 from Ohio. Intern, U. S. Naval Hospital, Great Lakes, Ill., 1930-31. Served with Epidemiology Unit, U. S. Naval Hospital, San Diego, Calif., and with Service Force, Pacific Fleet. Member: American Medical Association and American Public Health Association. Diplomate: National Board of Medical Examiners.

Barker, Vincent L., Commander (MC) USNR (Inactive) (*Ganglioneuroma*, p. 298). A. B., DePauw University, 1923; M. D., Indiana University School of Medicine, 1928. Intern, St. Luke's Hospital, Chicago, Ill., 1928, and Henry Ford Hospital, Detroit, Mich., 1928-32; private practice, Monroe, Mich., 1932-42; former chief of staff, Mercy Hospital, Monroe, Mich. Commissioned surgeon, USNR, 8 Apr. 1942. Specialty: Surgery and pathology. Served at U. S. Naval Training Station, Great Lakes, Ill., and at U. S. Naval Hospital, Norman, Okla. Released from active duty 10 Dec. 1945.

Berkley, William L., Captain (MC) USN (*A Case of Migraine With Lesion Localized in the Visual Tract*, p. 290). B. A., Vanderbilt University, 1926; M. D., Vanderbilt University School of Medicine, 1929. Appointed assistant surgeon, USN, 26 June 1929. Specialty: Ophthalmology. Post-graduate study: University of Vienna, 1934, U. S. Naval Medical School, 1935-36, and Washington University, 1937-38. Served at U. S. Naval Hospital, Bremerton, Wash.; with Pacific Fleet and South Pacific Command; and at U. S. Naval Hospital, St. Albans, N. Y. Fellow: American College of Surgeons, American Academy of Ophthalmology and Otolaryngology, and American Medical Association. Diplomate: American Board of Ophthalmology.

Braun, Winston, Lieutenant (MC) USNR (Inactive) (*Metastatic Tumor in the Heart*, p. 275). A. B., University of Tennessee, 1938; M. D., University of Arkansas School of Medicine, 1943. Appointed ensign, H-V(P) USNR, 24 Feb. 1942; classification changed to assistant surgeon, USNR, 22 Nov. 1943. Intern, Baptist Memorial Hospital, Memphis, Tenn., July 1943-July 1944. Served at U. S. Naval Air Transport Training Center, Memphis, Tenn.; aboard landing ship tank in European Theatre and beach party medical officer in Iwo Jima and Okinawa invasions. Released from active duty 30 Aug. 1946.

Caes, Henry J., Lieutenant Commander (MC) USN (*Ganglioneuroma*, p. 298). M. D., New York Medical College, Flower and Fifth Avenue Hospitals, 1941. Appointed acting assistant surgeon 10 June 1941. Specialty: Pathology. Intern, U. S. Naval Hospital, Brooklyn, N. Y., June 1941-July 1942; resident in pathology, National Naval Medical Center, Bethesda, Md., Sept. 1943-Sept. 1944, and U. S. Naval Hospital, Mare Island, Calif.; served on U. S. S. *Relief*. Resigned Aug. 1947. Now instructor and assistant pathologist, New York Medical College, Flower and Fifth Avenue Hospitals, New York, N. Y.

Callahan, John J., Lieutenant (MC) USNR (Inactive) (*Interesting Notes on Bipartite Patellae*, p. 229). B. S., University of Washington, 1938; M. D., McGill University Faculty of Medicine, 1942. Intern, 1942-43, and resident in orthopedic surgery, 1943-44, Providence Hospital, Seattle, Wash. Appointed assistant surgeon, USNR, 21 Jan. 1944. Served in South Pacific Theatre; at U. S. Naval Hospital, Seattle, Wash. Released from active duty 6 June 1946.

Chipman, Irvin Lewis, Jr., Lieutenant (MC) USN (*Hemorrhage Associated with Gastritis*, p. 253). A. B., Dartmouth College, 1940; M. D., University of Pennsylvania School of Medicine, 1943. Appointed ensign, H-V(P) USNR, 10 Jan. 1942 from Delaware; classification changed to acting assistant surgeon, USN, 29 Apr. 1943. Intern, U. S. Naval Hospital, Philadelphia, Pa., May 1943-Feb. 1944. Served on U. S. S. *Conway* and U. S. Naval Hospital, Philadelphia, Pa. Resigned 7 May 1947. Diplomate: National Board of Medical Examiners. Now resident in medicine, Veterans' Administration Hospital, White River Junction, Vt.

Clark, David G., Commander (MC) USNR (Inactive) (*Anesthesia Activities Aboard U. S. S. "Benevolence"*, p. 190). B. S., University of Nevada, 1934; M. D., Columbia University College of Physicians and Surgeons, 1938. Intern, Central Islip State Hospital, Central Islip, N. Y., 1938-39; intern and resident in surgery, Presbyterian Hospital, New York, N. Y., 1939-41. Appointed assistant surgeon, USNR, 25 Feb. 1941. Served with First Marine Division, Fleet Marine Force. Post-graduate course in anesthesia, Mayo Clinic, 1944-45. Released from active duty 22 Jan. 1946. Resident in surgery, Presbyterian Hospital, 1946; chief of surgery, Veterans' Hospital, Reno, Nev., 1948. Diplomate: American Board of Surgery.

Connelly, Joseph R., Lieutenant Commander (MC) USN (*Hodgkin's Disease*, p. 180). A. B., St. Peter's College, 1936; M. D., Temple University School of Medicine, 1940. Intern, 1940-42, and resident, June 1942-Nov. 1942, Temple University Hospital, Philadelphia, Pa. Appointed assistant surgeon, USN, 12 Nov. 1942 from Pennsylvania. Specialty: Surgery. Served on U. S. S. *Wadsworth* and at U. S. Naval Hospital, Philadelphia, Pa.

Crowe, Walter W., commander (DC) USN (*Fixation of Mandibular Fractures With Report of Three Cases*, p. 278). D. D. S., College of Dentistry, University of Southern California, 1929. Staff, division of oral surgery, Wads-

worth Hospital, U. S. Veterans Bureau, West Los Angeles, Calif., 1930-33; private practice, Westwood Village, West Los Angeles, Calif., 1934-36. Appointed lieutenant, junior grade, (DC) USN, 3 Mar. 1936 from California. Served on U. S. S. *Holland* and U. S. S. *South Dakota*; and at U. S. Naval Training Station, San Diego, Calif., and U. S. Naval Hospital, San Diego, Calif. Member: American Dental Association.

Duffner, Gerald J., Lieutenant Commander (MC) USN (*A Study of the Effect of Breathing Oxygen or Normal Air After Exposure to an Atmosphere Having a High Concentration of Carbon Dioxide*, p. 234). B. A., University of Denver, 1938; M. D., University of Colorado School of Medicine, 1941. Research assistantship: National Jewish Hospital, Denver, Colo., 1933-36; physiology department, University of Denver, 1936-37; physiology and pharmacology department, University of Colorado, 1937-41; intern, U. S. Public Health Service, U. S. Marine Hospital, New Orleans, La., 1941-42. Appointed assistant surgeon, USNR, 7 Aug. 1942 from Colorado; transferred to Regular Navy 3 Oct. 1945. Specialty: Submarine medicine. Served on U. S. S. *New Jersey* and at U. S. Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.

Floyd, Thomas M., Lieutenant Commander (MSC) USN (*A Dysentery Outbreak Aboard a Cruiser in Apra Harbor, Guam, Marianas*, p. 240). B. S., Howard College, 1936; University of Chicago, 1937-41. Graduate assistant in bacteriology, University of Chicago; instructor in bacteriology, Ohio University. Appointed ensign, H-V(S) USNR from Alabama 28 Oct. 1941; transferred to Regular Navy as lieutenant commander (MSC) 16 Oct. 1947. Served at U. S. Naval Training Center, Great Lakes, Ill.; with Malaria Control Unit, Solomon Islands and New Caledonia; with Japanese "B" Encephalitis Research Team, Okinawa and China; at U. S. Naval Medical Center, Guam, 1947. Member: Society of American Bacteriologists, Society of Illinois Bacteriologists, Society of Ohio Bacteriologists, National Malaria Society, and American Association for the Advancement of Science.

Gaenslen, Frederick G., Lieutenant (MC) USNR (*Salmonella Osteomyelitis*, p. 306). B. A., Ripon College, 1937; M. D., University of Wisconsin Medical School, 1940. Intern, Graduate Hospital of the University of Pennsylvania, Philadelphia, Pa., 1940-42; resident, State of Wisconsin General Hospital, Madison, Wis., 1942-44. Appointed assistant surgeon, USNR, 17 Nov. 1943. Specialty: Orthopedic surgery. Served at U. S. Naval Air Station, San Diego, Calif., U. S. Naval Hospital, Oakland, Calif., and on U. S. S. *Shadwell*. Resigned 17 Dec. 1947. Member: Milwaukee County Medical Society, State Medical Society of Wisconsin, and American Medical Association.

Gilliam, Robert D., Lieutenant (MC) USN (*A Case of Migraine With Lesion Localized in the Visual Tract*, p. 290). A. B., Princeton University, 1939; M. D., Temple University School of Medicine, 1943. Appointed ensign, H-V(P) USNR, 9 May 1942; classification changed to acting assistant surgeon, USN, 23 March 1943 from Pennsylvania. Specialty: Ophthalmology. Intern, U. S. Naval Hospital, Philadelphia, Pa., May 1943-Jan. 1944. Served on U. S. S. *Bernadou* and U. S. S. *Point Cruz*, and at U. S. Naval Hospital, Balnbridge, Md. Member: American Medical Association.

Gunther, Lewis, Commander (MC) USN (*Aphorisms on Peptic Ulcer Seen in the Naval Service*, p. 207). Junior Certificate, University of California at Los Angeles, 1921; M. D., Yale University School of Medicine, 1926. Intern, Los Angeles County Hospital, 1926; assistant resident in medicine, 1927, and

assistant in medicine, 1928-29, University of California Medical School; attending physician, Los Angeles County Hospital, 1929-37; associate senior physician, Cedars of Lebanon Hospital, Los Angeles, 1942; consulting supervisor, Cedars of Lebanon Medical Clinic; cochief, cardiology, Mount Sinai Hospital, Los Angeles; consulting physician, University of California at Los Angeles; attending physician, Santa Monica Hospital and St. John's Hospital, Santa Monica, Calif., 1942; associate clinical professor of medicine, College of Medical Evangelists and senior attending physician, Los Angeles County Hospital. Appointed assistant surgeon USN, 1 July 1940. Specialty: Internal medicine. Served at U. S. Naval Hospital, Pearl Harbor, T. H.; U. S. Naval Hospital, Aiea Heights, T. H.; U. S. Naval Hospital, Long Beach, Calif. Resigned 2 Sept. 1947. Fellow: American Medical Association; associate fellow: American College of Physicians; member: American Heart Association. Diplomate: American Board of Internal Medicine.

Hayter, Robert, Lieutenant Commander (MC) USN (*A Study of the Effect of Breathing Oxygen or Normal Air After Exposure to an Atmosphere Having a High Concentration of Carbon Dioxide*, p. 234). B. A., University of Oregon, 1933; B. A., Oxford University, 1937; M. D., University of Oregon Medical School, July 1940-June 1942. Intern, University of Oregon Medical School Hospitals and Clinics, Portland, Oreg. Appointed assistant surgeon, USNR, 16 Apr. 1942 from Oregon; transferred to Regular Navy 12 Nov. 1942. Served at Submarine Base, Pearl Harbor, T. H., and at U. S. Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md. Resigned 15 Dec. 1947.

Hoffmann, George Towle, Lieutenant (MC) USNR (Inactive) (*Metastatic Tumor in the Heart*, p. 275). A. B., Georgetown University, 1939; M. D., Harvard Medical School, 1943. Intern, Bellevue Hospital, New York, N. Y., July 1943-July 1944. Appointed ensign, H-V(P) USNR, 7 Feb. 1942; classification changed to assistant surgeon, USNR, 18 May 1943. Served in Pacific Theatre. Released from active duty 3 June 1946.

Lewis, Gwilym B., Lieutenant Commander (MC) USN (*Intramedullary Fixation of Fractures of the Femur*, p. 161). A. B., University of Redlands, 1936; M. B., 1940, and M. D., 1942, Northwestern University Medical School. Appointed acting assistant surgeon, USN, 2 July 1941. Intern, U. S. Naval Hospital, Mare Island, Calif.; resident in orthopedic surgery, U. S. Naval Hospital, Oakland, Calif. Served at U. S. Naval Aviation Training Center, Corpus Christi, Tex.; with Composite Squadron 27, Pacific Fleet; aboard U. S. S. *Savo Island*.

McCoy, James J., Jr., Lieutenant Commander (MC) USN (*Hodgkin's Disease Involving the Epicardium*, p. 272). B. S., Manhattan College, 1936; M. D., Columbia University College of Physicians and Surgeons, 1940. Intern, Medical Center of Jersey City, Jersey City, N. J., Jan. 1941-Apr. 1942. Appointed assistant surgeon, USNR, 21 Mar. 1942 from New York; transferred to Regular Navy May 1943. Served on U. S. S. *Tarazed* and at U. S. Naval Hospital, Brooklyn, N. Y. Resigned 15 May 1947. Now senior pathologist, Central Islip State Hospital, Central Islip, Long Island, N. Y. Member: The Medical Society of the State of New York.

Metcalf, John W., Commander (MC) USN (*Specific Therapy in Osteomyelitis*, p. 175). A. B., 1931, and B. S., 1934, University of Kansas; M. D., University of Kansas School of Medicine, 1934. Intern, King County Hospital, Seattle, Wash., July 1934-Feb. 1936; private practice, Seattle, Wash., 1936-39. Ap-

pointed assistant surgeon, USN, 16 Dec. 1939 from Washington. Specialty: Orthopedic surgery. Served on U. S. S. *California* and U. S. S. *Benevolence*; at U. S. Naval Hospital, San Diego, Calif., and U. S. Naval Hospital, Alea Heights, T. H. Member: Washington State Medical Society, King County Medical Society, and Hawaii Territorial Medical Association.

Mount, Robert A., Commander (MC) USN (*A Dysentery Outbreak Aboard a Cruiser in Apra Harbor, Guam, Marianas Islands*, p. 240). M. D., Baylor University College of Medicine, 1938. Intern, June 1938–June 1940, and resident, June 1940–Apr. 1941, Jefferson Davis Hospital, Houston, Tex. Appointed assistant surgeon, USN, 20 Mar. 1941 from Texas. Specialty: Epidemiology and tropical medicine. Served with malaria control unit in the Pacific Theatre and at U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md. Fellow: American Medical Association.

Moxon, Robert K., Lieutenant (MC) USN (*Acute Disseminated Lupus Erythematosus*, p. 286). A. B., University of Pennsylvania; M. D., University of Pennsylvania School of Medicine, 1943. Appointed ensign, H–V(P) USNR, 20 March 1942; classification changed to apprentice seaman, V–12(S) USNR, 5 May 1943; appointed acting assistant surgeon, USN, 22 Dec. 1943. Specialty: Internal Medicine. Intern, U. S. Naval Hospital, Philadelphia, Pa. Served with Garrison Beach Battalion No. 2 at Okinawa and on U. S. S. *Piedmont*. Fellow: American Medical Association; Associate member: Philadelphia County Medical Society.

Murray, William D., Lieutenant H(S) USNR (Inactive) (*Filariasis Studies in American Samoa*, p. 327). B. A. (biology), 1934, and M. S. (entomology), 1935, Ohio State University; Ph. D. (entomology and zoology), University of Minnesota, 1940. Instructor in botany and zoology, Eveleth Junior College, Eveleth, Minn., 1941–42; instructor in biology, Bemidji State Teachers College, Bemidji, Minn., Mar. 1942–June 1943; research fellow, Ohio State University, July 1943–Sept. 1943. Appointed lieutenant, junior grade, H–V(S) USNR, 16 Dec. 1943. Served with malariology unit, Third Fleet, South Pacific Theatre. Released from active duty 7 Mar. 1946.

Reitz, Harvey E., Commander (MC) USN (*A Review of Present Methods in the Early Diagnosis of Bronchogenic Carcinoma*, p. 198). M. D., University of Kansas School of Medicine, 1938. Intern, Louisville General Hospital, Louisville, Ky., 1938–39; resident, Wesley Hospital, Wichita, Kans., 1939–40. Appointed assistant surgeon, USNR, 21 Jan. 1941 from Kansas; transferred to Regular Navy 13 July 1943. Served on U. S. S. *Maryland*, U. S. S. *Omaha*, U. S. S. *Alabama*; and at U. S. Naval Hospital, Long Beach, Calif. Member: American Medical Association and Kansas Medical Society.

Schlack, Carl A., Commander (DC) USN (*A Modification of an Oral Photographic Apparatus Originally Constructed by the Dental School, University of Pennsylvania*, p. 312). D. D. S., The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1929. Private practice, 1929–34; instructor in oral histology, histopathology, and comparative odontology, The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1931–36; lecturer, dental hygienist classes, 1933–36; research fellow, Pennsylvania College of Dental Surgery, 1934–36; associate professor in oral hygiene, School of Dentistry, Georgetown University, 1941 and 1942. Appointed lieutenant, junior grade (DC) USN, 11 Apr. 1936. Specialty: Oral pathology, dental research. Served at U. S. Naval Dental School and Naval Medical Research Institute, National

Naval Medical Center, Bethesda, Md.; on U. S. S. *Wisconsin*; and U. S. S. *Houston*. Fellow: American Association for the Advancement of Science; member: International Association for Dental Research, American Dental Association, and American Academy of Oral Pathology.

Smith, James T., Lieutenant Commander (MC) USN (*Hodgkin's Disease*, p. 180). B. S., Fordham University, 1936; M. D., Long Island College of Medicine, 1941. Resident in pathology, Mary Immaculate Hospital, Jamaica, N. Y., July-Dec. 1941; intern, Morrisania City Hospital, New York, N. Y., Jan.-July 1942. Appointed assistant surgeon, USNR, 14 June 1941; transferred to Regular Navy. Served with 26th U. S. Naval Construction Battalion; on U. S. S. *Tryon*; and at U. S. Naval Hospital, Philadelphia, Pa. Resigned 1 May 1947. Member: American Medical Association.

Solomon, Philip, Commander (MC) USNR (Inactive) (*The Use of Plasma in the Treatment of Combat Fatigue*, p. 226). B. S., Harvard University, 1926; M. D., Harvard Medical School, 1930. Resident neurologist, Boston City Hospital, 1932-33; assistant in neurology, 1932-33, Austin teaching fellow in neuropathology, 1933-34, and in neurology, 1934-35, and assistant in neurology, 1936-, Harvard Medical School; junior visiting neurologist, Boston City Hospital, 1935-; assistant physician, Boston Psychopathic Hospital, 1935-36; assistant psychiatrist, Massachusetts General Hospital, Boston, 1935-36; research assistant in psychology, Brown University, 1936-37; senior psychiatrist, Massachusetts Department of Mental Health, 1937-38; psychiatrist, Habit Clinic for Child Guidance, Boston, Mass., 1937-41; consulting psychiatrist, New Hampshire Children's Aid Society, 1937-41; instructor in psychiatry, Tufts College Medical School; junior visiting neurologist, Beth Israel Hospital, Boston, 1938-41. Appointed passed assistant surgeon, USNR, 14 Feb. 1941. Served at U. S. Naval Training Station, Newport, R. I., and with the Sixth Marine Division in the field. Released from active duty 11 Apr. 1946. Member: Los Angeles County Medical Association. Diplomate: American Board of Psychiatry and Neurology and National Board of Medical Examiners.

Straughan, Joseph M., Lieutenant (MC) USN (*Hodgkin's Disease*, p. 180). M. D., University of Pennsylvania School of Medicine, 1942. Appointed acting assistant surgeon, USN, 12 May 1942 from West Virginia. Specialty: General surgery. Intern, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Served at U. S. Naval Base Hospital No. 9; with First Beach Battalion; at U. S. Naval Hospital, Philadelphia, Pa.; and on U. S. S. *Hector*.

Walker, Russell H., Commander (MC) USN (*Fatal Anaphylaxis Following Typhus Vaccine Injection*, p. 303). B. S., University of Oklahoma, 1930; M. D., University of Oklahoma School of Medicine, 1932. Intern, U. S. Marine Hospital, San Francisco, California, 1932-33; resident in surgery, Witaker Hospital, Pryor, Okla., 1933-35; first lieutenant, Medical Reserve, USA, 1935-37. Appointed assistant surgeon, USN, 1 Aug. 1937 from Oklahoma. Specialty: Pathology. Served in the Philippine Islands and in China prior to World War II and with the First Marine Division and on U. S. S. *Tranquillity* during World War II.

Ware, Robert L., Captain (MC) USN (*Diseases of Importance to the Navy*, p. 153). B. S., Emory University, 1928; M. D., Emory University School of Medicine, 1931. Appointed assistant surgeon, USN, 8 June 1931. Intern, U. S. Naval Hospital, League Island, Philadelphia, Pa. Served at various

east coast naval hospitals and overseas with Amphibious Forces, Pacific Theatre; the Fleet Marine Force, Atlantic; on U. S. S. *Tutuila* and U. S. S. *Denver*; chief, Medical Statistics Division, Bureau of Medicine and Surgery, Navy Dept. Fellow: American College of Surgeons.

Wiggins, Howell E., Commander (MC) USN (*Intramedullary Fixation of Fractures of the Femur*, p. 161). B. S., and M. D., University of Oklahoma School of Medicine, 1936. Intern, 1936-37, and resident in internal medicine, 1937-38, Cedars of Lebanon Hospital, Los Angeles, Calif. Appointed assistant surgeon, USN, 16 July 1938 from Oklahoma. Specialty: Orthopedics. Served at U. S. Naval Hospital, Oakland, Calif. Fellow: American Medical Association.



20

UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

ME 48

NUMBER 3

JUN 15 1948

RECORDS DIVISION



MAY-JUNE 1948

Bimonthly

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMEP P-112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

17 June 1948 is the fiftieth anniversary of the establishment, by Congress, of the Hospital Corps of the U. S. Navy. The cover picture shows a typical hospital corpsman ready for trouble during World War II. John W. Galbreath, pharmacist's mate, third class, aboard the carrier *Saratoga* awaits the return of planes from the 5 November 1943 raid on Rabaul.

—Official U. S. Navy Photo.

VOL. 48

MAY-JUNE 1948

NO. 3

UNITED STATES NAVAL MEDICAL BULLETIN

**THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**



BIMONTHLY

**DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY**

Compiled and published under the authority of
Naval Appropriations Act for fiscal year 1948,
Public Law No. 202, approved July 18, 1947

**UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1948**

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.



Because the supply of certain numbers of the BULLETIN is exhausted and because of the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated :

All numbers up to and including 1921.
Volume 16, 1922, No. 5.
Volume 17, 1922, No. 4.
Volume 18, 1923, Nos. 1, 3, and 5.
Volume 19, 1923, No. 3.
Volume 20, 1924, No. 5.
Volume 24, 1926, Nos. 1, 2, and 4.
Volume 25, 1927, No. 1.
Volume 26, 1928, Nos. 1 and 3.
Volume 31, 1933, No. 3.
Volume 42, 1944, Nos. 2 and 6.
Volume 44, 1945, No. 6.
March 1946 Supplement.
Volume 47, 1947, No. 6.



SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$1.75 ; foreign subscription, \$2.25.

Single number, 35 cents.

Exchange of publications will be extended to medical and scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

II

PREFACE



The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

CLIFFORD A. SWANSON,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS



Contributions to the **BULLETIN** should be typewritten, double-spaced, on plain paper of standard letter size and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions and the style laid down in the Government Printing Office Style Manual for spelling, abbreviations, capitalization, and the use of figures.

All pictures should be unmounted. Do not cut out portions of illustrations to be reproduced. Photographs should be black and white glossy prints, preferably 4 by 5 or 8 by 10 inches to allow for reduction. Do not make any marks on face of photograph nor type or write on back as these impressions show through and may mar the picture. Staples, paper clips, or pins should not be used on illustrations. All charts and graphs must be drawn with black india ink on white paper. If graph lines are to appear they should be in other than blue printing ink.

Contributions are to be the original work of the author and great care should be exercised to enclose in quotation marks quotations which may be introduced. Full credit for the source for these quotations should also be given. Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the **BULLETIN** should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps,
United States Navy, Ret. Act.

TABLE OF CONTENTS



PREFACE	Page III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Medical Matériel Logistics in the United States Navy—Murphy K. Cureton	353
Production of Anti-Rh Sera From Placental Tissue of Sensitized Women—John J. Engelfried and Fredrick R. Henry	370
Use of Pedicle Skin Grafts in Repair of Surface Defects of the Lower Extremities—William Requarth	373
Observations on the Efficacy of Benadryl in the Therapy of Rheumatic Fever—United States Naval Medical Research Unit No. 4	380
Present-Day Concepts of Epidemiology—George E. Foley	386
Dermatitis Due to the Preparation and Administration of Penicillin Solution—William C. Marsh and William N. New	391
Pterygium: A Simple Efficient Method of Treatment—Henry G. Bullwinkel	395
Streptothricosis; Report of a Case With Recovery—Walter L. Schafer	399
Prolonged Laboratory Observations on Clinical Cases and Carriers of "Shigella flexneri III" Following an Epidemic—Frank R. Philbrook, La Verne A. Barnes, William J. McCann, Jr., and Russell R. Harrison ..	405
The Treatment of Fractures of Edentulous Mandibles; a Review—Sidney C. Liedman	415
CLINICAL CASES FOR DIAGNOSIS	434

NAVAL MEDICAL HISTORY

1898-1948	435
The First Maritime Hospital and the Second Oldest Hospital in the New World (In Santos, Brazil)—Odair Pacheco Pedroso; translated by Carroll P. Hungate	437

EDITORIALS

The Cause of Limitations of Knee Motion After Fracture of the Shaft of the Femur	440
Immunization Against Poliomyelitis	441
The Oath of Hippocrates	441
Posture	442
Number of Births in United States in 1947	443
Individualism in Diet	444
The Sins of Mass Serology	445
Naval Medical Journals	445
Correct Diagnosis for Clinical Cases	446
NOTICES OF DEATHS IN MEDICAL AND DENTAL CORPS	447

CLINICAL NOTES

Sulfadiazine Anuria; Its Relief by Bilateral Renal Decapsulation and Nephrostomy—Clifford F. Storey and John A. Fowler	448
Discussion of Pulmonary Tuberculosis Treated With Phrenic Crush and Pneumoperitoneum Therapy; Report of Two Cases—Jerry J. Zarriello ..	454
Rupture of the Spleen in Infectious Mononucleosis; Report of a Case—Samuel P. Hicks	460
Reiter's Disease; a Review With Presentation of a Case—Stephen L. Magiera	463
Traumatic Rupture of the Mesentery of a Meckel's Diverticulum; Report of a Case—Edward S. Lowe	467

BOOK NOTICES

Sexual Behavior in the Human Male, Kinsey, Pomeroy, and Martin—Roentgen Interpretation, Holmes and Robbins—Surgical Pathology, Boyd—Pharmaceutical Laboratory Manual, Kuever—Diagnosis and Treatment of Pulmonary Tuberculosis, Stone and Dufault—Uterotubal Insufflation, Rubin—Surgical Disorders of the Chest, Donaldson—Rypins' Medical Licensure Examinations, prepared under editorial direction of Bierring, with collaboration of a review panel—Elementary Medical Physics, Stearns—Emotional Maturity, Saul—Obstetrics and Gynaecology, Russell—Public Health Administration in the United States, Smillie—Handbook of Psychiatry, Overholser—An Introduction to Sociology and Social Problems, Jensen—The Essentials of Obstetrics and Gynecology, Scott—Cancer, Ackerman	471
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

PREVENTIVE MEDICINE

The Spread of Influenza A and Other Acute Respiratory Diseases in a United States Naval Training Center—<i>James R. Kingston, Elma T. Jarrett, O. C. Dierkhising, and W. H. Wells</i>	478
Air-Borne Photofluorographic Unit—<i>John M. Loré</i>	490
NOTES ON CONTRIBUTORS	496

**Commanding officer, executive officer, and civilian consultants at
the U. S. Naval Hospital, Chelsea, Mass.¹**



- | | | |
|-------------------------------------------------|------------------------------------------------------------|-------------------------------------------------|
| 1. DR. CANNON ELEY
Pediatrics | 15. MR. F. R. HARDING
Medical Photography | 29. DR. R. H. BARKER
Obstetrics & Gynecology |
| 2. DR. BENJ. TENNEY
Obstetrics & Gynecology | 16. DR. HANIBAL HAMLIN
Neurosurgery | 30. DR. A. T. HERTIG
Obstetric Pathology |
| 3. DR. C. S. SWAN
Urology | 17. CAPT. JOEL J. WHITE
Medical Officer in Com-
mand | 31. DR. J. W. TOUMAY
Orthopedics |
| 4. DR. D. L. FARNSWORTH
Internal Medicine | 18. DR. E. B. WERT
Pathology | 32. DR. R. E. MABREY
Proctology |
| 5. DR. W. F. MURPHY
Psychiatry | 19. CAPT. JAMES F. HAYS
Executive Officer | 33. DR. N. J. WILSON
Thoracic Surgery |
| 6. DR. W. S. BURRAGE
Allergy | 20. DR. SYLVESTER MCGINN
Cardiology | 34. DR. HERBERT ADAMS
Thoracic Surgery |
| 7. DR. M. M. TOLMAN
Dermatology | 21. DR. B. M. JACOBSON
Hematology | 35. DR. SHIELDS WARREN
Pathology |
| 8. DR. GEO. DUNLOP
General Surgery | 22. DR. A. G. BRAILEY
Internal Medicine | 36. DR. J. S. BARR
Orthopedics |
| 9. DR. R. W. SMITH
Anesthesiology | 23. DR. GEO. AUSTEN
Urology | 37. DR. L. G. RICHARDS
Otolaryngology |
| 10. DR. J. W. NORCROSS
Hematology | 24. DR. S. J. GRAY
Internal Medicine | 38. DR. C. I. JOHNSON
Otolaryngology |
| 11. DR. L. M. HOYT
Internal Medicine | 25. DR. KENDALL EMERSON
Internal Medicine | 39. DR. H. W. HUDSON
General Surgery |
| 12. DR. H. B. SPRAGUE
Cardiology | 26. DR. H. S. SISE
Internal Medicine | 40. DR. L. V. HAND
Anesthesiology |
| 13. DR. D. L. HALBERSLEBEN
Internal Medicine | 27. DR. T. C. PRATT
General Surgery | 41. DR. J. J. REGAN
Ophthalmology |
| 14. DR. J. H. MARKS
Roentgenology | 28. DR. W. A. MEISSNER
Pathology | 42. DR. R. J. JOPLIN
Orthopedics |

¹ Since this photograph was taken Dr. R. C. Allen and Dr. U. H. Eversole, anesthesiology ; Dr. R. B. Nelson, obstetrics and gynecology ; Dr. R. S. Schwab, neurology ; Dr. J. G. White, neurosurgery ; Dr. D. E. Harken, thoracic surgery ; and Dr. D. G. Cogan, ophthalmology, have been added to the staff consultants.

ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO NO.



WASHINGTON 25, D. C.



20 May 1948

Fellow Officers of the Medical Department:

On June 17, 1898, in the midst of the Spanish-American War, Congress passed the Act establishing the Hospital Corps of the Navy. June 17th this year is its 50th Anniversary. With the Medical Corps, which really dates from the early days of the American Revolution, it shares the double honor of being a "war baby" and one of the two oldest members of the Medical Department.

During the half century of its existence, the Hospital Corps has rendered service of inestimable value to the Navy in years of peace and through two of the greatest wars in history. The courage and devotion to duty displayed by its members have won the admiration and gratitude of the Nation.

One of the striking features of the individual hospital corpsman is his versatility. He not only nurses patients, gives first aid, dispenses drugs or supervises sanitary measures, but he has often erected temporary hospitals, made roads, driven ambulances and trucks, repaired plumbing or planted gardens.

The professional work of the hospital corpsman is also remarkable for its varied character. Medical and technical technicians of every kind are required: laboratory x-ray, prosthetic and physiotherapy, to name only a few of them. The training and assignment of these technicians is a task of great importance as their work is necessary in every phase of caring for the sick and injured of the Navy.

I want to tell of an incident that shows both the courage and humor that has helped men to keep their sanity in the dreadful scenes of battle 10,000 miles from their homeland. During the night bombardment of our forces on Guadalcanal by a Japanese fleet during the early days of the fighting on that island, the big shells were bursting among our positions, lighting up the coconut trees with their flashes and shaking the ground with earthquake-like explosions, a young pharmacist's mate, who had been hugging the ground, was tossed in the air and turned over as a cook flips a pancake. When he recovered a little, he said with a grin: "I'll never forget this--if I live another two hours."

The June 1948 issue of the HOSPITAL CORPS QUARTERLY is a special number to celebrate the golden anniversary of the Hospital Corps. It is hoped that this letter will draw attention to this anniversary and to the splendid work and glorious history of the Hospital Corps.

Sincerely,

Rear Admiral, Medical Corps
Surgeon General, United States Navy.

U. S. NAVAL MEDICAL BULLETIN

VOL. 48

MAY-JUNE 1948

No. 3

*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



MEDICAL MATÉRIEL LOGISTICS IN THE UNITED STATES NAVY

MURPHY K. CURETON

Captain (MC) U. S. N.

STANDARD dictionaries define logistics as the branch of military science that embraces the details of moving or supplying armies and the general conduct of a campaign. A more specific definition for this discussion provides for the delivery of the correct quantity and quality of matériel to the place where needed at the time required. The constantly changing concept of total and global warfare has tremendously increased the problems and difficulties to be met in the practice of matériel logistics. The increased tempo of events to be anticipated from the addition of jet propulsion, guided missiles, and atomic energy to the developments of World War II enlarges the problems and responsibilities of matériel logistic planning. On two occasions seekers for world domination have erred in leaving the United States undisturbed to serve as the reservoir of their defeat. It would be an act of total irresponsibility to assume that such an error might be committed a third time.

The standard training program for medical students and naval medical officers leaves little time for consideration of the problems of supply

¹ The policy of the U. S. NAVAL MEDICAL BULLETIN as printed on the cover of its first issue and maintained throughout the 41 years of its existence.

sources and methods. The ward medical officer prescribes treatment for his patients. The surgeon determines the type and time of operations to be performed and the types of instruments desired. Provision of supplies and equipment, even the determination of numbers of individual instruments required, is left to others. This lack of understanding, on the part of the medical officer, of the problems he is creating adds enormously to the burdens of supply personnel. Logistics personnel have learned that only through complete understanding of the usages and customs of consumers can efficient performance of the supply function be maintained. They cannot afford to adopt the attitude that the consumer either does not know what he wants or needs what he requests. By the same token it is reasonable to expect that requests will be based upon factual knowledge as to what is required, the purpose for which it is intended and the quantity actually needed. The rather widespread practices of ordering new items "to see what it is" and of padding quantities requested "so the depot will have something to cut off" indicate serious misunderstanding on the part of personnel of consuming agencies. In the interest of general understanding and cooperation in common problems a discussion of medical matériel logistics is presented.

The over-all logistic problems of the Bureau of Medicine and Surgery are the responsibility of the Assistant Chief of the Bureau for Planning and Logistics. Under his supervision and control are the Planning Division and the Matériel Division. The Planning Division deals with, plans for, and determines the requirement for buildings, grounds, and fixed equipment for Medical Department installations ashore and afloat. The Matériel Division determines the requirement for supplies other than fixed equipment both as to quantity and time of purchase; and directs and supervises the procurement, inspection, storage, and distribution of the same. Purely financial aspects of logistic consideration are the responsibility of the Finance Division with the Chief of the Division being responsible to the Deputy Chief of the Bureau of Medicine and Surgery.

The fundamental structure of matériel logistics may be set forth by providing accurate answers to four basic questions: "What?" "When?" "Where?" "How?" It is well, however, to bear in mind that such simplification is possible only in the presence of complete understanding of the vast significance of each word in these one word questions.

The term "What?" implies the determination with regard to all items available, which individual items shall be supplied and, with regard to individual items, the quantity of each to be supplied. In practice these calculations are separated into the functions of (a) development, (b) matériel selection, and (c) requirements.

MATÉRIEL SELECTION

Matériel development and selection are the responsibility of the Naval Medical Matériel Board. This board is composed of thoroughly experienced Medical, Dental, and Hospital Corps officers and scientists. Here lies the responsibility for modification of the Army-Navy Catalog of Medical Matériel. The board receives applications from commercial producers presenting items for sale to the Navy and recommendations from members of the Medical Department who desire the addition of an article to the medical armamentarium of the Navy. The board is responsible for a continuing review of the catalog to assure that the selection of items offered there coincides with the changing and advancing practice of sound and scientific medical and surgical procedures.

Upon presentation of an item for consideration by Matériel Board a thorough study is made as to its suitability for use under service conditions, whether it is a duplicate or is superior or inferior to an item already supplied, whether it will serve a necessity of the service commensurate with its cost, and whether it has proceeded beyond the stage of the experimental in sound scientific usage. Under the press of a total war economy, it is needful to determine availability of the item or of the raw materials contained therein. It may become necessary to choose between the new item and one already in use, on the basis of insufficient raw material to produce both. Finally, determination as to availability as a competitive item or sufficient justification for purchase under proprietary certification is required.

All the assistance of wide professional and service experience is available to the board in making determinations. Complete scientific laboratory investigation may be had. The services of the Research Division are available. Specific problems relating to reports of unsatisfactory material and details of development or improvement of items to meet the specific needs are referred to the Engineering Development Division of the Army-Navy Medical Procurement Office for investigation. A service trial and report on the proposed item may be ordered.

In the event that the Medical Matériel Board concludes that an item is worthy of addition to the catalog or should be deleted as no longer required, an appropriate recommendation is submitted to the Chief of the Bureau. In the case of a recommendation to add an item, a statement is included to show the recommended distribution, the quantity of the initial procurement, and the estimated cost. If approved by the Chief of the Bureau, the recommendations of the Board are transmitted to the Matériel Division for appropriate action, including coordination with the Army through the Army-Navy Medical Matériel and Specifications Board.

REQUIREMENTS PLANNING

Sharing the responsibility in the determination as to "What?" and "When?" is the Requirements Branch of the Matériel Division. This branch operates under the supervision of the requirements officer. He is assisted by professional advisers who in turn lend technical and professional advice and guidance to the class or group monitors. To each monitor is assigned a class or group of items listed in the medical catalog. The monitor is responsible for a constant and continuing review of each item under his control. He must be constantly aware of the quantities and location of stocks on hand and on order, rates and types of issues, rates and types of receipts, and rate of deterioration or usage. He must be well informed with respect to plans and programs of the Navy Department, all of which affect the requirement for items under his control. The monitor, with the aid of his professional adviser, must keep abreast of changing uses and customs of professional practice. Failure to do so will certainly lead to distressing shortages or to exasperating excesses.

An illustration of such an incident, which occurred under wartime restriction of information, has to do with penicillin. At a time when production of penicillin was strictly limited by War Production Board order and when issues of the drug had to be limited to cases of infection due to organisms known to be amenable to penicillin therapy, conditions in the field caused the initiation of the practice of prophylactic administration of sizable doses of the drug to recently wounded men. No warning of this practice was sent to supply agencies either before or after its initiation. The first indication of changed methods came only when requisitions began to pour in. The time required to secure new allocations of raw materials from the War Production Board, place contracts, manufacture and test the increased quantities, and distribute the product to a world-wide fighting front led to the development of a most distressing shortage. Fortunately, sufficient matériel was immediately available to meet the crisis at the expense of depleted pipe-line quantities. No personnel suffered for lack of the drug. However, the condition could have been avoided had the requirements officer been advised that prophylactic use of the drug was about to be initiated. No rule or method of mathematics will indicate a requirement for a drug for prophylactic use when orders are to provide only for proved infections from specified organisms. Even in wartime the number of infections can be predicted as can the number of wounds, provided the statistician has accurate information as to the plan of operations. It is not enough for the statistician to secure his basic information from newspaper headlines. But the use of one factor instead of the other is fatally confusing in requirements planning.

The class monitor, under the supervision of the professional adviser, must be constantly aware of the trend of receipts and issues with regard to each item under his control. In the event of a continuing decline in the rate of use for a given item, he is charged with the responsibility for determining the reason for the decline in popularity. Several factors must be considered in such a determination. An advance in medical knowledge may have revealed a better therapeutic agent. Disagreeable or dangerous side reactions may have been traced to the item. The condition for which it is used may have gone into a long period of low incidence. The development of drug-resistant strains of bacteria may have occasioned less satisfactory results from its use. Of further concern in the face of a declining issue rate is the fact that a point may be reached where the quantity required is insufficient to justify stocking the item. It may then be the duty of the monitor to initiate a recommendation to the Medical Matériel Board that the item be deleted from the catalog, provided he becomes convinced that the decline in popularity probably will be permanent.

The frequent changes in practice in the treatments of burns provide an outstanding illustration of the factors just described. Within the experience of persons now in the Medical Supply Service the therapeutics of burns has involved Carron oil, picric acid solution, paraffin spray, tannic acid solution, tannic acid and silver nitrate, tannic acid jelly, medicated petrolatum, and pure petrolatum. One element of this picture presents a real puzzle. Since the advent of the use of tannic acid solution in the therapy of burns the rate of issue of tannic acid powder has remained almost constant. There were minor decreases in rate of issue with the advent of each new therapeutic regimen. That tannic acid powder is not used for burns or for other purposes is indicated by the fact that returned stores of this item from decommissioned activities often closely approximate original issues. The small quantities not returned probably represent the amount used for astringent solutions and ointments. Yet the current rate of issue remains fairly constant.

In addition to maintaining stock levels of all items against changing demands of current operations, the Requirements Branch is accountable for keeping sufficiently informed as to new concepts of warfare, new offensive and defensive weapons and tactics, and new developments in the fields of preventive medicine and in therapeutic medicine to assure that items and quantities available for issue will be those, and only those, items and quantities the future need for which may reasonably be anticipated. It should be emphasized that the full discharge of this responsibility implies a breadth and depth of vision quite beyond the popular conception of the role and capabilities of a requirements planning group. Yet such emphasis points up the importance

of the position of correct and realistic requirements planning in the over-all schedule looking toward the preservation and perpetuation of our country.

Not only is the requirements planning group responsible to provide for the needs of the Navy in peace and in war; all too often there are emergencies involving the civilian economy and health to an extent that surpasses the capacities of civilian agencies. In such situations reserve supplies of the armed forces are required for immediate alleviation of civilian need. Three instances in point have to do with the threat of a smallpox epidemic in the Pacific Northwest in 1946, a similar threat in the New York area in 1947, and the recent cholera epidemic in Egypt. In these instances large quantities of vaccine were obtained from the Naval Medical Supply System.

Thus far the discussion of requirements planning with respect to quantities has been deliberately misleading in that only quantities for use have been indicated. This deception was intended to point up a most confusing and little appreciated element of the logistic problem which has to do with "pipe-line quantities." It may be recalled that at the time the "Big Inch" pipe line was placed in service it required about 3 weeks continuous pumping to fill the pipe line before delivery at destination began. The volume of oil required in the filling process can be obtained by a relatively simple calculation. The determination of pipe-line quantity in medical logistics is a much more complicated problem.

The term "in the pipe line" may be applied to all stores nominally under the control of the medical supply system from the time of receipt from the manufacturer until all consuming activities have a sufficient quantity in their storerooms to provide for day to day requirements. Actual rate of use figures from consuming agencies must form the basis for estimating quantities required. Each consumer should determine his rate of use per month for each item. From that basic figure a determination is made as to the minimum below which stock on hand may not safely go. In the same manner there is established a maximum to which stock should be held in the interest of economy. Minimum and maximum quantities ordinarily are established by Bureau orders. An intermediate level, the order point, is established. This level should be the requirement for the minimum period, increased by the requirement for the average period of time required to receive delivery of material on routine requisition. Where the minimum is established as stock for 6 months, the maximum is stock for 12 months, and the requisition time is 2 months; the order point would be set at 8 months. When the stock on hand is depleted to the order point a supply for 6 months should be requested. Normal delivery 2 months after order would not exceed the maximum stock period.

Because it is not feasible to compile usage rates from every consuming activity, requirements planning personnel assume as such usage rates the rates of issue from medical supply issue points. These rates of issue are carefully compiled on a monthly basis. However, the problem is not quite so simple. Quantities issued on requisitions may be for normal use (recurring issues), or to expand an activity or to augment the working stock (nonrecurring issues). By way of keeping the pipe-line quantity accurate these two types of issues are tabulated separately. Only those quantities classed as recurring issues are considered in the determination of usage rates. Determination of requirements to satisfy nonrecurring issue demands must be made through accurate advance information regarding plans of operation and medical department programs.

In addition to tabulations of issue data it is necessary to consider sources and types of receipts in the establishment of usage rates. For this purpose receipts are classed as receipts from purchase and receipts from returned stores. The latter is subdivided into receipts from decommissioned activities and those reduced in capacity and receipts from activities where excess quantities have been accumulated. Only those receipts from excess quantities affect the usage rate.

Another source of information is developed by a study of property surveys. Quantities, particularly of dated items, appearing on property surveys indicate that more was ordered and received than could be utilized prior to potency expiration. In using information from surveys the monitor must be careful to check procurement and stock status. There are occasions when the exigencies of procurement require that stocks be issued so close to the date of expiration that full utilization of the material cannot be expected. Such a situation has occurred frequently with respect to x-ray film and certain biologicals. In order to avoid certain loss it is requisite that such items be ordered in quantities sufficient for the requirements for only half the normal potency period.

These components are combined to provide a usage rate which is then adjusted to the established maximum stock period. Thereafter the adjusted usage quantity is combined with planned requirements for nonrecurring issue and pipe-line quantity to provide a maximum stock quantity. Upon this basic calculation there is then established a maximum stock quantity and an order point in the same manner as that described above for the consuming activity.

The final phase of the requirements planning function is the requirements review period. At specified intervals the requirement for each item of medical matériel is reviewed and adjusted as may be indicated by variations that may have occurred in any of the factors noted above as affecting the anticipated need. The frequency of periodic review

is determined with respect to each item after consideration of individual characteristics. Of particular importance are durability, volume either as to storage space requirement or as to monetary value, and procurement lead time considered with impact upon industry. The latter term may well be expanded. Procurement lead time refers to that period between preparation of a purchase order and receipt of the product within the Medical Supply System. The impact of government orders upon industry must be carefully gaged if efficiency and economy are to be attained. In the case of some items the volume of required quantities may be so small as to indicate annual purchases. In other instances the volume or the durability may be such as to indicate monthly procurement. With respect to items of seasonal production it may be advantageous to so place contracts as to allow production for the government to coincide with periods of slack production for the civilian economy. With respect to certain items, special tools and production methods are essential. In that event relatively infrequent individual purchases are more economical as well as producing a smaller degree of disruption of industrial productivity.

The next step in the review of requirements is to establish the relationship between the quantity required and the quantity available and thereby to determine the quantity to be purchased. The formula for this determination requires that the total quantity required for the determined review period shall be reduced by the quantity on hand in the Medical Supply System, the quantity on order from contractors, and the quantity that it is estimated will be received as returned stores. The estimation of quantities to be received as returned stores can be made on the basis of past receipts adjusted to allow for known or anticipated decommissionings or reductions of naval activities. The resulting unsatisfied requirement is further adjusted to cover the factors discussed as determinative in the establishment of the frequency of the requirements review period. Finally, the portion of required quantities remaining unsatisfied is adjusted by a factor for contingencies. The contingent factor is the final expression of the judgment and intuition of the requirements planning officer. It may be heresy to admit that intuition has a place in sound planning. Yet the possession of an imaginative understanding of the fundamental principles of logistic planning, intuition, is the crowning glory of the successful requirements planner. In any event the finally adjusted requirement is transmitted as a purchase order to the Army-Navy Medical Procurement Office.

ARMY-NAVY MEDICAL PROCUREMENT OFFICE

The functional organization and accomplishments of the Army-Navy Medical Procurement Agency and of the Army-Navy Medical

Procurement Office have been adequately described elsewhere.^{1 2} It is sufficient for the purpose of this discussion to say that ANMPO (Army-Navy Medical Procurement Office) arranges the purchase, inspection, and delivery of material in the quantities, at the times, and to the places within the Medical Supply System designated by the Requirements Branch of the Matériel Division. It is, however, considered to be advisable and conducive to a clear understanding of certain situations that have developed or may be expected to develop, to comment briefly upon those elements which tend to detract from the ideal picture indicated.

It is necessary that the requirements planning group be adequately informed regarding market conditions and industrial potential as affected by the factors of availability of raw materials, the condition of the labor market, and the demands of the civilian economy, yet it is not reasonable to expect the planning group to maintain as intimate information of these factors as must be demanded of the purchasing group in ANMPO. Occasionally there has been severe criticism of the Medical Supply System because items were in short supply or out of stock because deliveries from contractors had been delayed weeks or months beyond the time specified in the contract. In some cases the delay has been due to incoordination between the planning and procurement functions. In other instances the delay has been due to unusual conditions in industry. The Nation's economy continues in the phase called the "seller's market." That is to say that there is a ready demand for any and all products with little discussion as to price or terms.

For so long a period as the civilian economy can easily absorb the entire volume of industrial production, a federal contracting officer is at a distinct disadvantage. Contractors not only do not seek government contracts but in many instances are actually loath to accept proffered business and often actually refuse to respond to requests for bids. Such a tendency is augmented by the natural inclination of a producer engaged in the competition for civilian markets to be assured that diversion of goods to fill government contracts will not weaken his position in the competitive market in the future when the advantages of the "seller's market" have disappeared. Here rests the explanation for the fact that individual hospitals frequently are able to buy the small quantities required for local use when the large quantity needed for the entire system cannot be procured.

¹ CAMPBELL, V. W. H.: Army-Navy Medical Matériel Coordination. U. S. Nav. M. Bull. 47: 481-493, May-June 1947.

² News and Comment: Army-Navy Medical Procurement Office. Bull. U. S. Army M. Dept. 6: 354-359, Oct. 1946.

DISTRIBUTION

The requirements planning and procurement functions of logistics have as their primary purpose the timely delivery of adequate materials to the consuming agencies of the Navy. Satisfactory accomplishment of that purpose requires that centralized procurement be supplemented by a suitable operative organization for distribution. Such an organization must serve to receive and store materials and to distribute individual items to supply the needs of consumers. Because the primary function of distribution is to supply the needs of the individual consumer, it follows that distributing points must be established at such locations as will provide to each consumer the best service it is possible to attain. A secondary purpose, and one that becomes increasingly important, is such dispersion of stored material that loss or destruction of one or more storage areas will produce the smallest possible disruption of service.

MEDICAL SUPPLY DEPOTS

In the Naval Medical Supply System the operative functions of distribution are delegated to the medical supply depots. At the high point of World War II the Medical Supply System comprised 5 medical supply depots, 10 named medical supply storehouses, 14 numbered supply storehouses, and, for mobile supply of the fleet and Advance Bases, 8 medical supply barges and medical sections in 27 general stores issue ships (AK's and AKS's), and several medical supply facilities which were subsidiary to various ones of the numbered storehouses. With the termination of hostilities, the general reduction in force was applied to the Medical Supply System. At the close of fiscal year 1947 there remained 4 medical supply depots, 1 named storehouse, since disestablished, and 3 medical stores sections of naval supply depots. For purposes of stock control and accounting, these activities were organized into 4 control points. The Naval Medical Supply Depot, Brooklyn, N. Y., is the control point for East Coast activities, including the Medical Stores Section, Naval Supply Depot, Mechanicsburg, Pa. The Naval Medical Supply Depot, Oakland, Calif., is the control point for West Coast activities, including the Medical Stores Section, Naval Supply Depots, Clearfield and Spokane. The Naval Medical Supply Depots, Pearl Harbor and Guam, serve respectively as control points for the Hawaiian and Marianas areas.

STOCK CONTROL AND WAREHOUSING

These closely associated phases of operational logistic practice provide concrete answers to the last two basic questions of sound matériel logistics. The stock control function envisages the maintenance of records as to what is received, when it is received, where, and from what

source; as well as recording what is issued, when, and to what activity. Warehousing duties include the physical receipt, handling, storage, issue and shipment of materials when and as directed by stock control.

It is essential that there be very close coordination between the stock control and warehousing functions in the determination as to where material is to be received into the Medical Supply System and the storage point or points from which issues are to be made to satisfy the requests of consuming agencies. The controlling factors in these determinations have to do with the availability of storage space suitable for each type of material, packing and handling capacity, and accessibility to transportation both into and out of storage.

The stock control function of the Medical Supply System is centered in the Inventory Control and Requirements Review Sections of the Requirements Branch and the Accounting Branch of the Matériel Division. The Accounting Branch concerns itself only with procedures of fiscal accounting for materials for which the Matériel Division is responsible. The Inventory Control Section is responsible for an equitable distribution of stocks of medical stores between the several major distribution points of the system. In addition, there is the responsibility for supplying to the requirements officer information regarding stock received, issued, and remaining on hand, so tabulated as to provide the type of information required in the process of requirements review.

The actual performance of the stock-control function is accomplished at the point of ultimate issue from the Medical Supply System to the using agency. At a specified time each month a Stock Status Report is prepared at each control point and forwarded to the Requirements Review Section of the Matériel Division where the four basic reports are consolidated into a single report from which information as to Navy-wide receipts, issues, and stock on hand is provided. Two other reports should be mentioned here in the interest of a clearer understanding of the discussion to follow. The first of these is a monthly report covering all items bearing a date of expiration of potency and giving for each item the date of expiration and quantity of each manufacturer's lot number. The second is a monthly report of storage space occupied, obligated, and available, and the weight of stores received and shipped during the month.

In the determination of the "Where?" of medical logistics, the Inventory Control Section of the Matériel Division consults the individual reports just outlined to determine the relative position of the several control points both as to stock on hand and storage space available. Under ideal conditions it would be possible to redistribute stock between control points as might be required. Actually as funds available for "Transportation of Things, Navy" have been reduced, the ideal solution is no longer possible. Under present conditions the only

redistribution that is possible is that which may be accomplished by careful allocation of contract deliveries from new purchases. Strictly speaking, such a limitation has a salutary effect for the reason that it commands a more careful allocation of stores in the first instance because there can be no correction of errors by reshipment of stores.

The mechanics of stores allocation finds a basis in the concept of areawise distribution. Essentially the Brooklyn Depot, with bulk storage at Mechanicsburg, Pa., serves the area eastward from the Continental Divide, including Atlantic and Caribbean areas. In like manner the Oakland Depot, with bulk storage at Clearfield and Spokane, serves the area westward from the Continental Divide, including Pacific and Alaskan areas. Contract deliveries are scheduled to control points at Brooklyn and Oakland. Pearl Harbor and Guam secure replenishment by transfer from Oakland. Primarily the Matériel Projects Section establishes a tabulation by areas of numbers and types of personnel, hospital patients, and activities. From that tabulation, new procurements of medical stores are allocated percentagewise to the two major areas. The basic allocation is adjusted to equalize existing stocks and to provide for anticipated demands on the basis of usage rates established through data supplied on Monthly Stock Status Reports and further modified in line with known or anticipated changes in personnel numbers as well as types and sizes of activities. The adjusted basic allocation is further reviewed by items for such modifications as may be indicated by the use for which individual items are intended. For example, components of field outfits are distributed in accordance with the basic demand for such items and modified as the operating plan anticipates variation in the area assignment of Advance Base and Field Forces.

Preparation for the receipt within the Medical Supply System of medical stores begins with the Requirements Review Section of the Matériel Division. Each stock-control point is informed as to quantities of individual items proposed to be stocked in spaces under that supervision. The quantities thus established are based upon the basic stock allocation desired, unless further modification is required by limitation of storage space under the supervision of the individual control point. The final quantity is transmitted to the designated control point.

Upon receipt of basic stock-allocation estimates the Stock Control Branch of the Medical Supply Depot supplies information as to the anticipated rate of issue as well as the estimated average quantity, and the range of quantity for individual issues, for each item. In the case of Oakland, the quantities to be transshipped to Pearl Harbor and Guam are added. Estimates are then passed to Warehousing Branch

personnel for establishment of definitive delivery points and final preparations for physical receipt of material.

Determinations of warehousing personnel are based upon the consideration of space availability, storage characteristics of spaces available, transportation and packing facilities; and, with regard to individual items, type of storage required, degree of security required, probable ultimate destination, amount of space required, probable rate of issue, and the probable number of issue units required by the average requisition. An additional and increasingly important consideration is the need for strategic dispersal of supplies and equipment to provide a reserve against total loss of an item through a single incident. To illustrate the problems involved in the preparation of a warehousing plan, a few instances are cited. Where the maximum stock quantity of one item may occupy one or two cases and require less than the 9 square feet of one pallet space, another item will fill several thousand cases and require many hundreds of square feet for storage space. One item may require one or several cases for a single unit of issue while another item may be so packaged that a single case contains several hundred issue units. Varying degrees of security may be required and for varying reasons. For example, stop watches require security to avoid simple pilferage while narcotics for obvious reasons require maximum security. Certain vaccines require storage at freezing temperatures while others require only moderate chill box storage and are damaged by freezing. Some drugs and solutions require heated storage to avoid cold weather loss by freezing. Other items require chill storage to avoid extremes of summer heat. Some items must be stored separately because of the danger of fire. An outstanding example is provided by methyl salicylate and calcium hypochlorite. These compounds, if brought in contact, produce fire with explosive suddenness.

The typical medical supply depot warehousing officer begins with the preparation of a floor plan or diagram of all available storage space. The characteristics of each area are indicated. The most suitable area is set aside for shelf or bin stock. In this area space is provided for each item for which the issue unit is less than the contents of a shipping case. Spaces are arranged and marked in catalog sequence. Space allotted to each item is determined first by the size of a case of the item and secondly by the number of cases normally issued within the time usually required to secure resupply of shelf stock from bulk storage areas.

Adjacent the shelf area, space is set aside for packing where items of shelf stock to fill individual requisitions are packed for shipment. Another space is set aside for assembly of case lot material from bulk storage spaces with repack cases from shelf stock so that all material for a single requisition can be delivered to the shipping space as a unit.

Remaining space is established for bulk storage by items in case lots. This space is subdivided as indicated by storage characteristics. Storage bays are established and identified by area and number, fire lanes and stores handling aisles are marked out, and finally the net floor area and floor load limits are computed for each type of storage available. In general, the parent depot provides refrigerated and security storage, and bulk storage to back up shelf items. Medical stores sections of inland depots provide general bulk storage from which large shipments of case lots extracted from requisitions may be taken.

The next step is to establish space and weight requirement for storage of maximum stock quantities as indicated by the stock control branch and to set aside the required space of the correct type of storage for each item to be stored. In the event that space available is less than the space required some adjustment may be made on the basis that some items move too rapidly to permit stock on hand to reach the maximum level as established. In no case is it safe to set up space for less than the minimum established level for a given item. On the other hand a reserve of space must be held against the possibility that some items may go into long supply for various reasons.

With specific space assignments prepared as described, the warehousing officer prepares shipping instructions in three categories: (1) specific delivery point for all items which must be stored at the parent depot for reasons of security, refrigeration, or small bulk; (2) percentage-wise deliveries for all items for which storage space availability may be calculated far in advance by reason of bulk, dispersion or rate of issue; (3) deferred determination for all items for which delivery point must be established specifically for each order after quantity and delivery date are known. After approval of delivery information by the stock control branch it is returned to the Requirements Review Section of the Matériel Division. Thereafter, as procurement directives are cleared by the Division specific delivery points are indicated for group 1 and 2 items. For group 3 items the depot is notified as to quantities and delivery dates on procurement directives and specific delivery point or points become an addendum to the procurement directive.

INSPECTION

An essential element of procurement for government agencies is the mechanism by which assurance is had that materials delivered are the same quality and quantity as that for which payment is made. In medical procurement there is the additional responsibility for assurance that materials are safe for use. This responsibility is pointed up by repeated instances during World War II in which large orders of intravenous fluids were found to be grossly contaminated. A very striking example is the instance in which a shipment of tablets pur-

chased as sulfathiazole were found during inspection to be phenobarbital. Drug manufacturers had their problems with inexperienced, careless, incompetent help as did other activities.

Inspection in the Naval Medical Supply System is a divided responsibility. Basic production inspection, contract management and general release procedures are the responsibility of the local office of the Inspector of Naval Matériel under direction and supervision of the Inspection Branch of the Army-Navy Medical Procurement Office. Technical inspection of finished products is the responsibility of the Laboratory Branch of the Army-Navy Medical Procurement Office. Final inspection as to transit damage, verification of marking and packaging, and certification as to quantities received is the responsibility of the receiving and inspection officer in the receiving depot. Reports of all predelivery inspections are delivered to him for final correlation.

RECEIVING

Upon physical receipt of a shipment of material at a medical supply depot, receiving department personnel prepare a standard record of receipt. If all inspection procedures are not found to be in order the material is held in that department until the defect is corrected. Upon satisfactory completion of all inspections the material is accepted and forwarded with necessary documents to warehousing spaces for storage. At the same time receiving documents are sent to the Stock Control Branch where the quantities are added to continuous inventory records and issues to consuming agencies may then be initiated. From the Stock Control Branch of the depot the receiving report is transmitted to the Matériel Division where appropriate entries are made in records maintained by Requirements and Accounting Branches. Originals of receiving documents are forwarded directly to the Fiscal Branch of the Army-Navy Medical Procurement Office and become the final authority for preparation of vouchers upon which the contractor is paid.

REQUISITION PROCESSING

The preparation of requisitions by consuming activities for needed medical supplies and equipment has been adequately explained by Bureau Circular Letters. It is intended as constructive criticism when it is stated that many activities either do not read and understand current circular letters on the subject or consider that it is too much trouble to follow instructions. In any case, the fact is that considerably more than 50 percent of requisitions received are found to be in error in some degree. It has come to be accepted as not unusual to receive frequent requests for changes in requisitions, either as to quan-

ties or as to required delivery date. To facilitate the handling of such requests an elaborate system of requisition control has been found to be essential. Immediately upon receipt of a requisition in the depot, the number and date of receipt are recorded on the requisition progress control card for the specific activity. The date of completion of each step in processing the requisition is entered on the same card. By this means any requisition can be quickly located at any stage. From the progress control desk the requisition is sent to the short supply control where items requested which are out of stock or in short supply are indicated. Errors in preparation as to expendability or stock number are noted. The next step is action by the requisition review board. This board is made up of medical and dental officers of wide experience who activate the basic policies and specific orders of the Bureau. The requisition is examined for correctness of preparation, a determination is reached that the activity is or is not entitled to the items requested under Bureau orders, and that quantities requested are in line with established allowances. Items out of stock or in short supply are placed on back order or reduced in quantity as appropriate. Every effort is made to serve the minimum needs of all activities so far as limited supplies will permit. The ideal is to have adequate supplies of every item to fill all requests as received. Such a situation will not prevail in the face of a continuation of a seller's market and exorbitant requests. The writer personally investigated a requisition in a case where it developed that the activity had a 4-year supply of the item in question and had requested enough for an additional 3 years. In that case it developed that the request was prepared by a stock clerk and had not been verified by any other person until it reached the depot.

From the review board the requisition is sent to stock control where items suitable for issue from bulk storage locations are indicated. Next, to machine records group, where priced invoices are prepared. Completed invoices are sent to appropriate storage locations where the materials are assembled, packed, marked, and request for bill of lading prepared. The shipment then moves to the shipping section and papers to the transportation officer for preparation of bill of lading and shipment booking. At this point it is well to stress that, in the absence of specific justification, only routine shipment by the most economical carrier is permitted. This limitation is imposed by Departmental authority and arises from limitation of appropriated funds for transportation. It is not enough to write "Emergency" on the requisition or to send a dispatch request for "Air shipment." Nor is simple failure to anticipate requirements sufficient justification for expedited and therefore more expensive shipment. Specific reasons in justification for expedited handling are necessary. Packages up to 4 pounds may be shipped as franked mail. Packages weighing 4 to

70 pounds are forwarded by parcel post at a cost for postage less than the cost for express shipment. With sufficient justification supplied by the requesting agency, 100 pounds for railway express or 10,000 pounds by freight may be shipped without a route order. In the absence of supporting facts to justify more expensive handling, all shipments must await transportation by naval vessels in coastwise transit or consolidated trapcar shipment for railway movement.

INVOICING

Requesting agencies are justifiably anxious to learn the fate of their requisitions. The invoicing procedure is arranged to meet this need. Upon completion of requisition review procedures, the second copy of the requisition showing all alterations, each indicated by a symbol, is mailed to the requesting agency with a form letter explaining the meaning of symbols used. As soon as the priced invoice has been prepared, the original (first) copy is mailed to the requesting agency. Upon receipt of the material this copy is to be receipted and mailed directly to the Matériel Division, Bureau of Medicine and Surgery, 84 Sands Street, Brooklyn, N. Y. At the same time copies two and four are mailed by the depot to the Matériel Division with supporting documents. Copies three, five, and six are sent to the storage section for use in assembling the material. As assembly progresses the case number or numbers for each item are indicated in the right marginal space. These copies with the request for bill of lading are sent to the transportation office. Upon completion of bill of lading the third copy of the invoice and the consignee's copy of the bill of lading are mailed to the requesting agency and should be held as file copies. The fifth copy is sent to the shipping office where it is placed in waterproof covering and securely attached to case number one of the shipment, as the packing copy. The sixth copy completes the files of the issuing depot.

CONCLUSION

In the interest of unification of effort and in the hope of greater understanding and simplification of mutual problems and responsibilities, an expanded outline of the task, the difficulties, and some of the solutions of medical material logistics has been presented. Unfortunately, the subject does not lend itself to humor and space does not permit the use of the multitude of examples from which reader interest might have been drawn. All reference to statistical data, as such, has been deliberately eliminated. The goal of matériel logistics is the delivery of exact quantities of exact items at exact places at exact times. That goal is something for which to strive but probably not to be attained. Logistics personnel hope that, with a great share of help and cooperation from operating forces, they may continue to improve and progress.

PRODUCTION OF ANTI-Rh SERA FROM PLACENTAL TISSUE OF SENSITIZED WOMEN^{1 2}

JOHN J. ENGELFRIED
Commander (MSC) U. S. N.
and

FREDERICK R. HENRY
Chief Hospital Corpsman, U. S. N.

THE importance of the Rh factor in pregnancy and in contemplated blood transfusions has created a marked demand for satisfactory anti-Rh testing sera. The majority of anti-Rh testing sera is human serum obtained from sensitized individuals. It is well known that only a small percent of these sensitized Rh-negative women have very high anti-Rh agglutinin titers. Since the present source of supply of these sera is limited, an attempt was made to find an additional source. Therefore the placentas of women sensitized during pregnancy to the Rh agglutinogens, were extracted and studied.

The blood and other fluids were removed from the placental tissues by filtration through several layers of gauze. These fluids were centrifuged to remove cells and other particles. The supernatant was tested for the presence of anti-Rh agglutinins as well as anti-A and anti-B agglutinins. The anti-A or anti-B agglutinins, when present, were removed by absorption with A or B, Rh-negative cells. After complete removal of the anti-A, anti-B agglutinins, the fluid was diluted with absorbed serum to give a final anti-Rh agglutinin titer of 1:128 and tested with various Rh-negative and Rh-positive cells.

The placental tissue was emulsified, with absorbed serum, and extracted overnight at refrigerator temperature. The following morning this mixture was centrifuged. The supernatant was titrated against O, Rh-positive cells to determine its anti-Rh agglutinin potency, and against A, Rh-negative and B, Rh-negative cells to determine the amount of absorption required to remove the anti-A and anti-B agglutinins. If either or both of the latter two agglutinins were present, they were removed by absorption before the placental

¹ From the Department of Serology, U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

² Received for publication 20 February 1948.

extract was diluted. When necessary, further dilution of the extract was made with absorbed serum to give an anti-Rh agglutinin titer of 1:128.

Preparation of diluent, for extraction and dilution.—Serum void of anti-A and anti-B agglutinins was necessary for this purpose. When possible, serum from AB individuals, either Rh-positive or Rh-negative was preferred, since these sera did not require absorption. However, most of the diluent used in this investigation was prepared from pooled serum absorbed for 1 hour, at room temperature, with excessive quantities of washed pooled, A and B cells. When necessary, a second and third absorption was performed. When plasma was used for diluent, it was first converted to serum by inactivation at 56° C. for 1 hour followed by centrifugation to remove the fibrin clot. After this it was absorbed with pooled A and B cells. Every batch of diluent was tested to insure the absence of any inhibitory substance. This was accomplished by titration of anti-Rh₀ serum of known titer, with pooled Rh-positive cells. The serial dilutions of the anti-Rh₀ serum and the Rh-positive cell suspension were made using as diluent the serum to be tested. The presence of any inhibitory substance in the diluent would decrease the titer of the anti-Rh₀ serum.

Absorption of anti-Rh serum, for removal of anti-A and anti-B agglutinins.—Serum and placental extract from type A individuals was absorbed with washed B, Rh-negative cells; from type B individuals with A, Rh-negative cells; from type O individuals with AB, Rh-negative cells, or with pooled A and B Rh-negative cells; while the serum or placental extract from AB patients required no absorption. Over-absorption was avoided by using small quantities of washed cells. Complete removal of the anti-A, anti-B agglutinins was not necessary in these sera having very high anti-Rh titers, since these sera required further dilution. However, the diluted testing sera contained no interfering trace of the anti-A, anti-B agglutinins.

RESULTS

Placenta No. 1.—This placenta was obtained from a type O, rh (cde) patient. The titers before absorption of the anti-A, anti-B agglutinins are illustrated in table 1.

TABLE 1.—Agglutinin titers

Agglutinins present	Mother's serum	Placental fluids	Placental tissue
Anti-A	1:1024	1:128	1:4
Anti-B	1:2048	1:512	1:1024
Anti-Rh	1:4096	1:1024	1:1024

Anti-Rh' agglutinins were present in weak concentrations; however, the diluted testing serum gave negative results with Rh' (cDe) cells. An anti-Rh₀ serum prepared from the mother's serum was used to test 1,125 routine blood specimens. This serum gave 85.61 percent Rh-positives and 14.39 percent Rh-negative results. An anti-Rh serum prepared from this placenta and the previously described serum was used simultaneously in testing 134 routine specimens and both sera gave identical results. After 3 months of refrigeration, this serum (prepared from placenta), showed no loss of potency on reiteration. Another lot of serum prepared from this placenta (after it had been frozen for 5 months) gave identical results with the control serum.

Placenta No. 2.—This mother was type A₁, rh(cde) and the father type O, Rh(CDe). The mother's serum before delivery had an anti-Rh₀ agglutinin titer of 1:256, the placental fluids a titer of 1:512, while the titer of the placental tissue was 1:1024. No other anti-Rh agglutinins could be detected. This placenta also produced a very satisfactory anti-Rh₀ testing serum.

Placenta No. 3.—The mother in this instance, was a type O, Rh'' (cdE) with a serum anti-Rh agglutinin titer of 1:64. The placental fluids and placental tissue had a low titer of 1:4. This placental extract produced very weak agglutination, therefore could not be used as a testing serum.

SUMMARY

Satisfactory anti-Rh₀ testing sera was prepared from the placental fluids and tissues, from two Rh-negative women known to be highly sensitized to the Rh agglutinogens.

ACKNOWLEDGMENT.—The authors are indebted to Capt. Paul Peterson (MC) USN for his aid in the procurement of the placental tissue and serum specimens

USE OF PEDICLE SKIN GRAFTS IN REPAIR OF SURFACE DEFECTS OF THE LOWER EXTREMITIES ¹

WILLIAM REQUARTH
Commander (MC) U. S. N. R.

CERTAIN types of surface defects of the lower extremities require pedicle grafts of skin and subcutaneous tissue for satisfactory closure. During the war, fragment and bullet wounds of the leg were common and these high velocity missiles produced mutilating wounds with destruction of wide areas of bone and skin. Healing occurred with deposition of dense scar which tended to break down and ulcerate after the slightest trauma. These patients were admitted to the plastic surgery centers for excision of the scar and replacement by durable skin. Many were awaiting orthopedic surgery and therefore thick flaps of skin and fat were required in order to permit operative procedures and provide sound healing of the operative wound.

There are various methods for repair of skin defects in the lower extremities. The scar may be excised, the edges undermined, and the skin pulled together. Due to the scarcity of tissue in the calf and foot, this is rarely possible unless the scar is very narrow. Excision followed by long relaxing incisions paralleling the defect to allow closure is more feasible. This has been termed the double pedicled flap. Local flaps or the procedure of swinging adjacent tissue over a defect are especially useful on the sole of the foot, although care must be taken not to deprive another area of tissue and thus create another defect. Free grafts are used primarily to obtain healing of granulating wounds. They survive poorly on bare bone or tendon and do not have enough body to replace thin scar over bone. A certain group of patients require both skin and subcutaneous tissue, especially those with deep tissue defects of those in whom a later operative procedure is planned.

¹From the Plastic Surgery Center, U. S. Naval Hospital, Great Lakes, Ill., and the Department of Surgery, University of Illinois College of Medicine, Chicago, Ill.



Figure 1a.—Defect of heel resulting from crushing wound by tractor. The wound is healed and there is very little loss of the os calcis. The sensitive scar breaks down easily.



Figure 1b.—First elevation of flap through two parallel incisions.



Figure 1c.—At second elevation transfer was contemplated but the flap was replaced when the blood supply of distal portion appeared inadequate. Appearance at 5 days. The outer layers of the skin are necrotic, but flap as a whole is intact.



Figure 1d.—Transfer to heel. The pedicle is divided in 3 weeks.



Figure 1e.—One week after final operation. To avoid ulceration insensitive flaps on weight-bearing portion of the feet must be protected until sensation returns.

A pedicle flap restores contour and fills out depressions, covers tendon and denuded bone and resurfaces the plantar surface of the foot. It supplies a covering through which extensive operative procedures, such as bone grafting, can be done. It is the next best substitute for the sole of the foot when a local flap cannot be used. The sole, however, is a special structure which has no other counterpart in the body and a pedicle graft is only a substitute and never a replacement (1). For this reason, local flaps are preferable. Scars of the sole cannot be removed by excision since there is no extra tissue available.

Pedicle flaps may be obtained from the abdomen or from the opposite normal extremity. Wrist-borne abdominal flaps are practically

never necessary. Their transfer requires many operations and much time is consumed, to say nothing of the patient's discomfort during the period of transfer. An abdominal tube must be constructed, then transferred to the wrist and later to the leg. In the past these "jump flaps" were used often but the tendency now is to avoid them unless clearly necessary.

The opposite uninjured leg can be used and the thigh is preferable. The higher the level the flap is cut, the better the blood supply and thigh flaps can occasionally be raised and transferred in a single operation. The abundance of subcutaneous tissue in this region provides a thick, healthy flap. An additional advantage is the fact that the scar of the donor site is hidden, a very important consideration in women. Often, however, defects low on the leg cannot be covered with thigh flaps because it requires that the knee be flexed at an acute angle and this is the source of much pain. In older individuals it may actually damage the knee joint. Therefore, although calf flaps are not the most desirable, they are often used (2) (3) (4) for low defects and it is the purpose here to discuss the operative technique for the transfer of such flaps.

Calf flaps can be applied to nearly any defect without great discomfort. They are raised on the medial and posterior aspects of the lower leg and never over the anterior surface of the tibia. By crossing the legs in various positions, they can be applied nearly anywhere in the lower extremities, hence the name "cross leg flap." However, the surgeon must be clearly aware of the hazard associated with their use. The circulation of the leg below the knee is precarious and varies considerably in various individuals, consequently the flap must be raised two and sometimes three times. Every precaution must be taken to be certain that the blood supply is



Figure 2a.—*Indolent ulcer of medial aspect of foot following fragment wounds. There was no x-ray evidence of active osteomyelitis but two successive intermediate thickness grafts failed.*

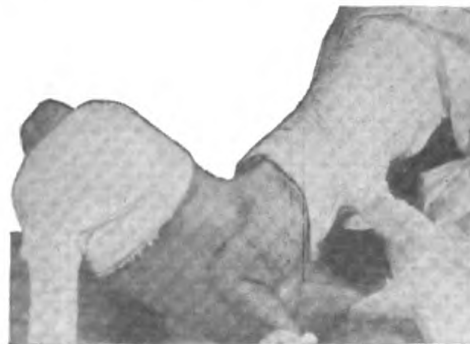


Figure 2b.—*Appearance of pedicle prior to division 3 weeks after transfer. There was considerable drainage during this period but the flap healed. One month after the final stage a small sinus appeared which drained for 4 months and finally healed. It is unwise to use a flap to cover a wound which will not support a free graft.*

adequate prior to transfer. In poorly nourished individuals, the flap is thin and has little subcutaneous tissue. Despite these disadvantages, it is often the only available flap in use for surface defects below the knee.

CONDITIONS

Before a pedicled skin flap is used, certain requirements must be met. The area to be covered should be healed. It may be necessary to cover it with a preliminary intermediate thickness graft. Brown (1) has pointed out that pedicle grafts do not survive on wounds which have repeatedly failed to support a free graft. Occasionally, however, persistent ulcers are seen which have resisted all efforts to heal and we may be justified in excising these and covering the area with a flap. Unfortunately, flaps transferred to such a contaminated surface often become grossly infected and do not heal well. If the donor leg is partially incapacitated or if there is not reasonable assurance that the flap will restore function, the operation should not be attempted. We must remember that the good leg is being mutilated and serious infection in the uninjured leg could permanently cripple a patient. Such a grave complication is rare, but has been known to occur.

TECHNIQUE OF OPERATION

A most important consideration is to accurately measure the defect and construct a facsimile of the flap from a piece of gauze and actually determine if the length and width are correct. The extremities are placed in a comfortable position and the imitation flap held on the uninjured leg in such a position that it adequately covers the defect. Only the medial and posterior surfaces of the calf are used and the base of the flap is always directed base upward.

As stated above, the arterial blood flow of the lower leg varies in different individuals and therefore a flap must be raised two or even three times to insure adequate blood supply. At the first operation it is outlined by two parallel incisions and a plane of cleavage is established just above the superficial fascia of the leg. The large sensory nerves should be avoided. The skin is undermined completely. Ten to fourteen days later it is raised again and the distal part cut across except for a quarter-inch bridge of skin. If the flap appears to have an adequate blood supply it is transferred at the time. However, if the blood supply is questionable, the flap is sutured back into place for 10 days. The quarter-inch bridge of skin prevents the distal suture line from pulling apart. This can occur easily and such a wound is very slow to heal.

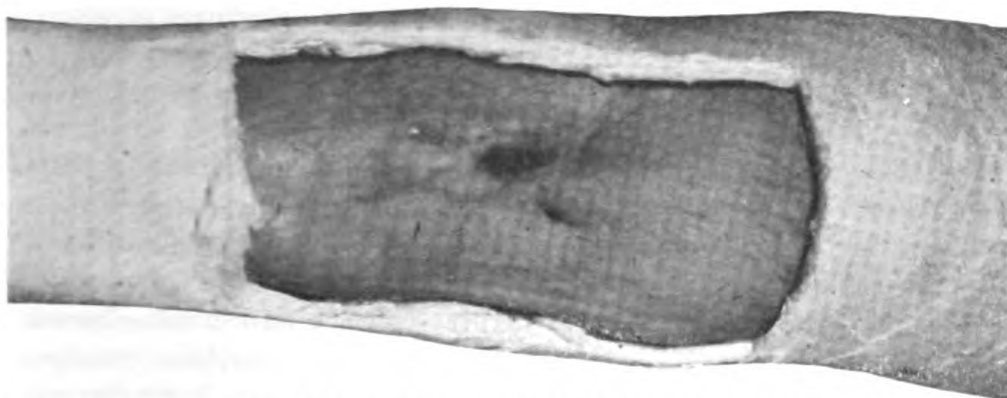


Figure 3a.—Compound fracture, both bones of leg, produced by machine-gun bullet. Appearance after bone sequestra had been removed and wound was nearly healed.

At the time of transfer, the flap is raised completely and the size of the bed decreased by undermining the skin edges and drawing them together. The remainder of the area is covered with a thick intermediate thickness graft cut from the opposite thigh. The graft is continued out onto the pedicle for 3 or 4 centimeters to decrease the area of open wound. A stent of mechanic's waste is tied over the graft and a pressure dressing applied. The dressing must be small in order not to interfere with the free portion of the flap.

The free end of the flap is placed over the injured area and the size of the defect which can be excised is outlined with the knife. As much of the flap is put into position as possible in order that the blood vessels which grow in can support the remainder 3 weeks later when it is detached. A light pressure dressing is put over the portion



Figure 3b.—Scar excised and area covered with wide flap raised on medial aspect of left leg. Patient later had a bone graft in orthopedic section.

that is sutured into place, care being taken not to compress any part of the pedicle.

There are various methods of fixation, but none are entirely satisfactory. Occasionally it is possible to secure the legs with padding and adhesive tape but this must be applied with considerable skill to ensure positive immobilization. Some apply casts before operation and work through large windows in the plaster, but this is not advised since the operative field is invariably contaminated. Others have made a pre-formed cast and attached it after the flap is transferred. Mills (5) suggested suspension of the extremities by overhead traction devices during application of the plaster. The many methods employed indicate that none are perfect and that application of the cast is a most difficult part of the procedure.

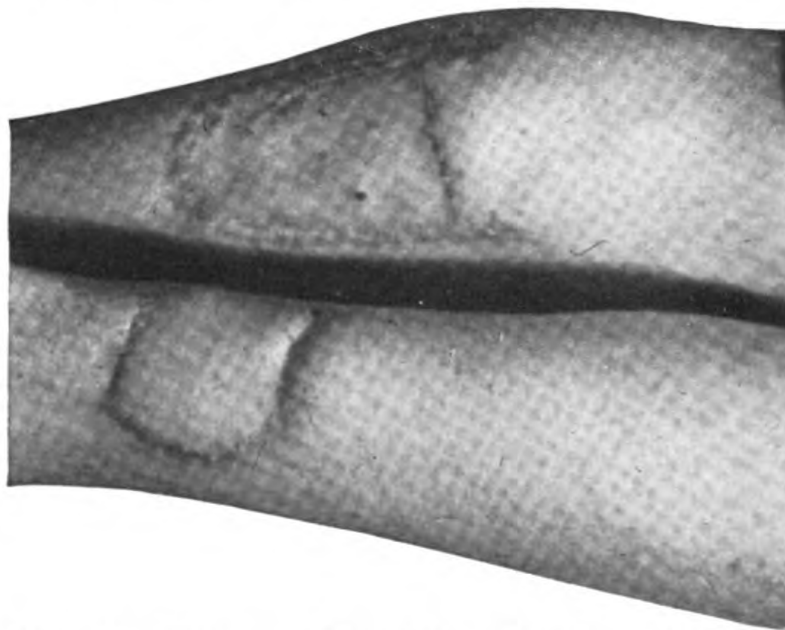


Figure 4.—Appearance of donor site and flap immediately post-operative in a patient who had a deep defect of the posterior aspect of the leg from a fragment wound. The donor site has been covered with an intermediate thickness graft. The scar produced is a serious disadvantage in female patients.

The extremities are put in a position which allows no tension or torsion on the pedicle. They are then held in this position by a responsible person, either the surgeon or first assistant. The pedicle is kept in full view until the plaster is hard. The legs are well padded and the plaster applied from the upper thigh to the lower leg and fixed in two places by cross bars.

POSTOPERATIVE CARE

The first few postoperative hours is the critical period and the flap should be inspected frequently to be certain that no tension or torsion

has occurred due to loss of position. If the circulation is embarrassed because of position, the surgeon must not hesitate to remove all the plaster and reapply it if necessary. Loss of a pedicle flap is a serious error and usually the result of carelessness, ignorance, or poor judgment. At the end of 3 weeks the pedicle is cut across, the flap revised and sutured into place. Flaps which cover the sole must be carefully protected from trauma. They are insensitive at first and very prone to ulcerate. Weight bearing should be limited and foam rubber pads worn in the shoes until sensation returns. A flap has all the nerve end organs and some short nerve fibers. Davis and Kitlowski (4) studied the return of sensation in pedicle flaps and found that pain appeared first, usually in about a month and advanced at about 1 cm. per month. Heat and cold appear next and touch last.

SUMMARY

1. The use of cross leg pedicle flaps to resurface defects of the lower extremity are discussed. Flaps of skin and subcutaneous tissue are useful where contour has been lost due to destruction of bone and are necessary to resurface areas where subsequent operative procedures are planned.

2. Wrist-borne abdominal flaps are rarely necessary and most defects can be closed by flaps taken from the opposite leg.

3. Thigh flaps are superior to those raised on the calf. The flap is thicker, has a better blood supply and can often be raised in one stage. They have a limited application because of the pain in the acutely flexed knee.

4. Calf flaps are adaptable to nearly all defects. Their blood supply is more precarious and they require several preliminary elevations before transfer. They should be used only as a matter of necessity when there is no other available flap, since the operation is associated with some hazard.

5. Pedicle flaps should not be transferred to unhealed wounds or wounds which will not support a free graft. One must be certain that the flap will cover the defect and restore function before mutilating the good leg.

6. The operative technique and method of fixation are discussed.

REFERENCES

1. BROWN, J. B. (St. Louis): Repair of surface defects of foot. *Ann. Surg.* 120: 417-430, Oct. 1944.
2. HAMM, W. G., and HARDY, S. B.: Repair of soft tissue defects of foot. *U. S. Nav. M. Bull.* 47: 263-271, Mar.-Apr. 1947.
3. PADGETT, E. C., and GASKINS, J. H.: Use of skin flaps in repair of scarred or ulcerative defects over bone and tendons. *Surgery* 18: 287-298, Sept. 1945.
4. DAVIS, J. S., in LEWIS: *Practice of surgery*. W. F. Prior & Co., Hagerstown, Md., 1944. Vol. 5, ch. 8.
5. MILLS, JAMES T.: Personal communication.

OBSERVATIONS ON THE EFFICACY OF BENADRYL IN THE THERAPY OF RHEUMATIC FEVER

UNITED STATES NAVAL MEDICAL RESEARCH UNIT NO. 4¹

BENADRYL (Beta-dimethylaminoethyl benzhydryl ether hydrochloride) has recently come into wide usage as a therapeutic agent of low toxicity and considerable efficacy in the control of a number of allergic phenomena. Its trial in the therapeusis of rheumatic fever was suggested by the widely accepted hypothesis that hypergy to Group A *hemolytic streptococci* plays an important role in the pathogenesis of this disease and by the fact that many of the manifestations of acute rheumatic fever are similar to those of known allergic states which have been reported to respond favorably to this drug. A review of the pharmacology of Benadryl (1) (2) (3) (4) (5) (6) suggested that if it were effective in the treatment of this disease, its action would be maximal if it were administered during the latent period preceding the onset of or early in the course of clinical rheumatic fever. In the absence of suitable clinical material in that category, it was thought desirable to select patients in whom abnormal clinical or laboratory findings commonly accepted as indicative of continued activity of the rheumatic process had been present over a sufficient length of time to allow accurate evaluation of the effects of the drug. Beneficial effects should be evidenced by amelioration of those manifestations or by alteration of the course of rheumatic process.

EXPERIMENTAL DESIGN

Patients considered by their ward medical officers to have had continuously active rheumatic fever of at least 4 months' duration were screened, and 16 men, 17 to 22 years of age, were selected for study. Each of these patients had suffered a definite onset of rheumatic fever, manifested by arthritis and/or carditis, from 4 to 21 months prior to Benadryl administration and in 4 of the men there

¹ Lt. Comdr. John R. Seal (MC) USN, Lt. Comdr. James B. Black, Jr., (MC) USN, Lt. Comdr. Robert L. Bailey (MC) USN, Lt. (jg) John S. Graettinger (MC) USNR, Lt. (jg) P. D. Cohn (MC) USNR, Lt. (jg) H. G. Nelson (MC) USNR, Lt. (jg) G. J. Friou (MC) USNR.

was a previous history of rheumatic fever. These patients were transferred to the research ward where they were placed on bed rest and all medication discontinued.

The 10-week period of study was divided into a control period of 4 weeks, a treatment period of 3 weeks during which one-half of the group received Benadryl and the other half served as controls, and an observation period of 3 weeks following treatment. During the entire 10 weeks all patients were examined daily by the same observer (JSG).

On the twenty-ninth day of observation, Benadryl therapy was started on eight patients. The drug was administered orally in 50 mg. capsules every 4 hours with a total dosage of 300 mg. daily for the first 5 days, 400 mg. daily for the next 7 days, and 500 mg. daily for the final 9 days of treatment in each patient. Each test subject accordingly received a total dosage of 8,800 mg. of the drug in divided doses over a 21-day period during which the eight control subjects received no therapy.

During the entire 10 weeks the following observations were made and recorded twice weekly: blood pressures in the supine and standing positions; body weight; electrocardiograms including precordial leads, C_F 2, 4, and 5; leukocyte and differential count; hemoglobin, Cutler sedimentation rate, and urinalysis. The Weltmann coagulation band and corrected Wintrobe sedimentation rate were determined once weekly. Total protein and albumin-globulin ratio determinations and erythrocyte counts were made on all patients at the beginning of the study. Throat cultures were done on all patients immediately after their transfer and thereafter whenever indicated by clinical or laboratory data.

In an effort to insure effective Benadryl dosage levels, serial histamine flare tests were done on all patients by the following method: Histamine phosphate, 0.1 cc. (0.036 mg. of histamine base) was injected intradermally into the flexor surface of one forearm. At 5 and 10 minutes after injection the wheal was measured across the axis of its greatest diameter and in the diameter perpendicular to this. These two diameters of the erythematous area were also measured in a similar manner and recorded. Intradermal injection of physiological saline in the other forearm served as a control. Two tests were made on each patient prior to the beginning of Benadryl administration and tests were made 29 hours after its beginning, and on the sixth, ninth, thirteenth, seventeenth, and twentieth days of therapy. They were also done on the first, second, third, and sixth days after its discontinuance. Tests on all 16 patients during the period of treatment were made 1 hour after the time a regular dose of Benadryl was given to those receiving the drug. The clinical and laboratory abnormalities

manifested by these patients during the 28-day observation period prior to Benadryl administration are tabulated in table 1.

TABLE 1.—*Effects of Benadryl on the manifestations observed during 28-day control period*

Patient No.	Months with disease	Arthralgia	Fever	Skin manifest	Unstable ECG	Elevation ESR	Elevation WBC	Benadryl given	Change during or after Benadryl therapy	Remarks
48.....	21	+	+	+	+	+	+	Yes	None.....	Erythema marginatum during control period.
51.....	14	0	+	0	+	0	+	Yes	None.....	Aortic diastolic developed preceding control period, decreased during therapy.
56.....	13	+	+	0	0	+	0	Yes	None.....	X-ray diagnosis rheumatoid arthritis made 2 months after study.
58.....	7	+	0	0	+	+	0	Yes	None.....	Arthralgia disappeared prior to Benadryl administration.
59.....	8	0	0	0	+	+	0	Yes	None.....	
60.....	11	0	0	+	+	+	0	Yes	None.....	Dermatographism abolished during therapy.
61.....	4	+	0	0	+	+	0	Yes	Improved.....	Decreased arthralgia, P-R interval, ESR, following therapy, has since developed aortic insufficiency.
63.....	5	+	0	+	0	+	+	Yes	Worse.....	Developed acute arthritic phenomena while on Benadryl.
49.....	14	0	0	0	0	+	+	No	None.....	
50.....	9	+	0	0	+	+	0	No	Improved.....	Arthralgia disappeared. ECG abnormalities have disappeared since study completed.
52.....	8	+	+	0	0	+	+	No	Improved.....	Arthralgia disappeared.
53.....	6	0	0	+	+	0	+	No	None.....	Variable first and second degree heart block throughout study.
54.....	10	0	0	0	0	+	0	No	None.....	
55.....	4	0	0	0	0	+	+	No	None.....	Arthritis at onset rapidly responded to salicylates and has not recurred.
57.....	10	+	+	0	0	+	+	No	None.....	
62.....	8	0	0	0	+	0	0	No	None.....	Aortic diastolic murmur decreased markedly.

RESULTS OF BENADRYL THERAPY

1. Benadryl, in the dosage used, had no appreciable effect on the course of the clinical manifestations in the treated group as compared with the control group who received no treatment.

2. The occurrence of irregular mottling and blotching of the skin seen in three patients was not decreased by Benadryl although dermatographism which was observed in one patient during the control period was abolished. In one patient, not included in this series, increasing Benadryl dosage schedules for 25 days, with administration of 700 mg. daily for the final 6 days, failed to affect the frequency of or the intensity of a recurrent erythema marginatum.

3. Neither the frequency nor severity of arthralgia was affected. Heat and swelling of the left wrist and metacarpophalangeal joints developed and persisted for 4 days in one subject receiving 500 mg. of Benadryl daily.

4. The incidence and course of intercurrent coryza in the treated group were not altered during treatment.

5. No significant alterations in temperature, pulse, or respiratory rates were observed during therapy. Blood pressure recordings in both the supine and standing positions were not appreciably different from control levels established prior to Benadryl administration.

6. No significant alterations occurred in either the normal or abnormal laboratory findings. No changes were observed to occur in the serial electrocardiograms of the test patients which could be attributed to Benadryl administration.

7. The method used to measure the size of the histamine-induced wheal and flare proved too inaccurate to warrant conclusions concerning possible suppression of cutaneous response to intradermal histamine by oral Benadryl administration.

SIDE EFFECTS

Drowsiness, lassitude, and dizziness have been reported to occur in over 50 percent of patients receiving Benadryl (7). In many patients these disappear during treatment; in others their severity has necessitated discontinuance of the drug. Dryness of the mouth and nervousness occur less frequently.

In the eight subjects who received Benadryl in this study, mild drowsiness was a transient phenomenon in five patients, whereas irritability and blurring of vision due to impaired accommodation occurred in seven and dryness of the mouth was present in five (table 2). Once irritability appeared it progressed and became severe enough in three patients to require the use of phenobarbital. There was no constant relationship between dosage or duration of administration and the severity of the other side effects.

Following discontinuance of Benadryl an unusual syndrome developed, characterized by anorexia, nausea, facial erythema, frontal headache, retching and vomiting. This syndrome will be reported in detail elsewhere (8).

TABLE 2.—Number of patients experiencing unpleasant side reactions and relation of symptoms to dosage of Benadryl

Symptom	300 mg. daily (5 days)	400 mg. daily (7 days)	500 mg. daily (9 days)	Total during 21 days	Comment
Irritability.....	2	6	7	7	Progressive severity with increasing dosage. Relieved by phenobarbital.
Blurring near vision.....	4	6	5	7	Interfered with ability to read.
Dryness of mouth.....	3	5	5	5	
Drowsiness.....	5	*2	*2	5	*3 patients drowsy on phenobarbital excluded.
Dizziness.....	0	0	2	2	
Anorexia.....	1	0	1	2	
Increased appetite.....	0	1	1	1	
Epigastric burning after medication.....	0	1	1	1	

DISCUSSION

If one accepts the role of hypersensitivity in the pathogenesis of rheumatic fever it would appear reasonable to investigate the effects of therapeutic agents in this disease which have proven to be of value in other forms of hypersensitivity. Rich and Gregory (9) (10) have emphasized the role of the anaphylactic mechanism of injury in the production of the rheumatic-like collagen changes which occur in experimental animals following a single large dose of foreign protein intravenously. The reported pharmacologic actions of Benadryl and the nature of the pathologic lesion in rheumatic fever would lead one to believe that this drug would not be of value after the rheumatic injury had been sustained. Rather, it should have its maximum effectiveness in the prevention of the anaphylactic injury and thus be most useful when administered in the latent period between the streptococcal infection and the appearance of clinical activity of the rheumatic process. Whether the mechanism of the anaphylactic injury is that of direct response to an antigen derived from Group A *hemolytic streptococci* or that of autosensitization to certain tissues under the influence of streptococcal infection (11) would appear to be immaterial to the rationale of the use of Benadryl or other antihistamine agents. Some experimental support for the trial of these drugs in the therapeutics of rheumatic fever has recently been published by Kyser et al. (12). He and his associates repeated the work of Rich and Gregory and in a small series of rabbits found that a high degree of protection from the vascular injury following foreign protein administration was afforded by the simultaneous administration of Benadryl.

We do not feel that the failure of Benadryl in the dosage used to significantly alter the course of chronically active rheumatic fever in these eight patients allows any conclusion as to its possible usefulness as a therapeutic agent in rheumatic fever. Studies of the efficacy of this drug or of similar drugs of higher potency in the prophylaxis and in the treatment of the acute manifestations of the disease at the time of onset might supply information which would be of value not only in the therapy of this disease but also concerning its mechanism.

SUMMARY AND CONCLUSIONS

1. Benadryl, in increasing dosage up to 500 mg. per day, was administered over a 21-day period to 8 of 16 patients exhibiting clinical or laboratory abnormalities attributed to long-continued activity of rheumatic fever. No apparent alteration in the course of the patients either during or after Benadryl therapy was observed.

2. An unpleasant reaction, manifested by facial erythema, throbbing frontal headache, anorexia, nausea, and vomiting occurred upon cessation of Benadryl.

3. The failure of Benadryl to favorably affect the course of chronically active rheumatic fever is to be expected. A review of the pharmacology of Benadryl and the recent report of its effectiveness in the prevention of anaphylactic vascular lesions in experimental animals suggest its trial in the prophylaxis and treatment of early acute rheumatic fever at a station where suitable clinical material is available.

REFERENCES

1. MCGAVACK, T. H.; ELIAS, H.; and BOYD, L. J.: Influence of dimethylaminoethyl benzhydryl ether hydrochloride (benadryl) upon normal persons and upon those suffering from disturbances of the autonomic nervous system; preliminary report. *J. Lab. & Clin. Med.* **31**: 560-574, May 1946.
2. WINDER, C. V.; KAISER, M. E.; ANDERSON, M. M.; and GLASSCO, E. M.: Myotropic spasmolytic, histaminolytic, and atropine-like actions of some derivatives of dimethylaminoethyl benzhydryl ether hydrochloride (benadryl). *J. Pharmacol. & Exper. Therap.* **87**: 121-131, June 1946.
3. CODE, C. F.: Discussion of benadryl as antihistamine substance. *Proc. Staff Meet., Mayo Clin.* **20**: 439-445, Nov. 14, 1945.
4. McELIN, T. W. and HORTON, B. T.: Clinical observations on use of benadryl; a new antihistamine substance. *Proc. Staff Meet., Mayo Clin.* **20**: 417-420, Nov. 14, 1945.
5. WELLS, J. A.; MORRIS, H. C.; and DRAGSTEDT, C. A.: Modification of anaphylaxis by benadryl. *Proc. Soc. Exper. Biol. & Med.* **61**: 104-106, Feb. 1946.
6. FEINBERG, S. M.: Histamine and antihistaminic agents; their experimental and therapeutic status. *J. A. M. A.* **132**: 702-713, Nov. 23, 1946.
7. FEINBERG, S. M.; DURHAM, O. C.; and DRAGSTEDT, C. A.: Allergy in Practice, 2d edition. The Yearbook Publishers, Inc., Chicago, Ill., 1946.
8. Naval Medical Research Unit No. 4: Unpleasant syndrome occurring subsequent to Benadryl therapy. (To be published.)
9. RICH, A. R., and GREGORY, J. E.: Experimental evidence that lesions with basic characteristics of rheumatic carditis can result from anaphylactic hypersensitivity. *Bull. Johns Hopkins Hosp.* **73**: 239-264, Oct. 1943.
10. RICH, A. R., and GREGORY, J. E.: Further experimental cardiac lesions of rheumatic type produced by anaphylactic hypersensitivity. *Bull. Johns Hopkins Hosp.* **75**: 115-134, Aug. 1944.
11. CAVELTI, P. A.: Autoantibodies in rheumatic fever. *Proc. Soc. Exper. Biol. & Med.* **60**: 379-381, Dec. 1945.
12. KYSER, F. A.; McCARTER, J. C.; and STENGLE, J.: Effect of antihistamine drugs upon serum-induced myocarditis in rabbits. *J. Lab. & Clin. Med.* **32**: 379-386, 1947.

ACKNOWLEDGMENT.—The technical assistance of J. L. Schmalzreid, CPhM; E. J. Maguire, PhM 1/c; F. J. Currie, PhM 3/c; H. S. Girardeau, PhM 3/c; J. Leventis, PhM 3/c; R. D. Loven, PhM 3/c; and W. V. Jones, HA 1/c, is gratefully acknowledged.

PRESENT-DAY CONCEPTS OF EPIDEMIOLOGY

GEORGE E. FOLEY

ETYMOLOGICALLY, epidemiology is defined as "the science or doctrine of epidemics." Some 20 years ago W. H. Frost¹ pointed out that contrary to etymologic definition, the science of epidemiology should embrace the interepidemic or endemic characteristics of disease since these phenomena cannot be properly separated from the temporary epidemic phase.

Usage, even then, had extended the meaning of the word beyond its original definition, to become a science of the natural history or mass-phenomena of disease in its endemic as well as epidemic form. Frost further suggested that the term should include the mass-phenomena of noninfectious disease as well.

In these intervening years, the philosophies and techniques of Frost's science have been applied to the mass study of mankind's ills from a number of approaches, both in the field and in the laboratory.

The current thought and direction of the many fascinating facets of epidemiology in its broadest concept were summarized in a letter written to Rear Admiral E. R. Stitt (MC) USN, Ret.,² by the late Lt. Stafford M. Wheeler (MC) USNR, who at the time was on leave of absence from his appointment as associate professor of epidemiology, College of Physicians and Surgeons and the De LaMarr Institute of Public Health, Columbia University. Dr. Wheeler was killed by a land mine explosion 13 April 1945 while on active duty in Yugoslavia with the American Typhus Commission. His letter to Admiral Stitt follows:

NAVAL MEDICAL SCHOOL
NATIONAL NAVAL MEDICAL CENTER
BETHESDA 14, MD.

MAY 8, 1944

MY DEAR ADMIRAL STITT:

I have found it very worth while to comply with your request for the present-day concepts of epidemiology, and the lines along which

¹ Frost, W. H.: *Epidemiology*, Nelson's Loose-Leaf Medicine, Vol. 2. Thomas Nelson & Sons, New York, N. Y., 1927. pp. 163-190.

² We wish to thank Admiral E. R. Stitt for his kind permission to publish Dr. Wheeler's letter.

this science is developing. It has forced me to reflect on the content of our thoughts in this field and to search for those ideas we hold today which may differ, for better or worse, from those of epidemiologists in earlier times. Whether or not the attempt is successful it has served to bring in review the various parts and pieces of the whole which make up our ideas on the subject today.

We still think of W. H. Frost as among the greatest of epidemiologists. His influence is still strong and his methods have not been superseded. One of the peculiarities of this science seems to be that solid contributions on a basis of reliable data don't go out of date but are constantly referred to and studied, whatever the local epidemiological problem may be. My guess is that few contributions in purely clinical or laboratory medicine dating from the middle of the 19th century are studied as frequently and carefully as John Snow on Cholera or Panum on Measles in the Faroe Islands.

From the point that Frost left off certain lines of development can be traced:

1. The experimental approach by the study of epizootics in controlled animal colonies—here, genetic methods such as inbreeding of successive generations of mice to produce uniformly resistant or susceptible strains, have helped to evaluate the relative importance of changes in virulence of the parasite as against changes in the immune status of the population in the genesis of epidemics. Webster's results point to the importance of the host factor in this respect. Another host factor which is now being approached by this method is the relation of immunity to the nutritional state. Only a beginning has been made on studies of environmental factors in artificial epizootics. An example of this is the work of Lurie on the air-borne spread of tubercle bacilli in rabbit colonies. Altering the temperature and humidity, in short creating artificial weather in animal populations may give valuable clues as to the reasons for seasonal and geographic differences in the incidence of communicable diseases.

2. Another recent development in relation to the host is the study of constitutional factors which underlie specific immunologic responses. Interest is centered on those inherent potentialities to resistance or infection after exposure which may be hereditary. Studies of family groups, sometimes back into the previous generations have been fruitful for certain diseases, such as poliomyelitis in its paralytic form, leprosy, rheumatic fever, and diabetes, although the problem of disentangling the effect of heredity and environment is still present in the interpretation of the findings.

3. As you remember, in Frost's article on epidemiology in Nelson's *Loose Leaf Medicine* he restricts the use of the term to the study of

specific infections of man. He admits the propriety of referring to the epidemiology of tuberculosis which is not epidemic in form and even to the mass-phenomena of a disease like scurvy which is not infectious, but one has the impression that in his opinion the proper sphere of epidemiological activity is largely within the acute communicable diseases.

Today, we consider epidemiology to have a broader scope and do not hesitate to talk of the epidemiology of cancer, diabetes, alcoholism, drug addiction, mental diseases, etc. There is a nice epidemiology developing on dental caries and its relation to mottled enamel and the fluorine content of drinking water. Many problems in industrial toxicology seem to be essentially epidemiological in nature. Here, the cases often occur in epidemic proportions as has happened in lead poisoning on several occasions. Stretching the point a bit, we might say that the epidemiological method has contributed successfully to the study of automobile and traffic accidents.

4. New discoveries or technical advances developed in the laboratory naturally are reflected in new tools for the epidemiologists. However, just because the subject matter changes—a new disease, a new skin test or antibody titration, it does not follow that the method of approach changes basically from the past. Epidemiological observations of scarlet fever and streptococcus infections on the basis of streptococcus types have refuted the Dick hypothesis of a single strain of streptococcus causing scarlet fever. Complement fixation tests for mumps reveal 50 percent of the population without history of mumps with titres suggesting previous infection which must have been at a subclinical level. On the other hand we are aware of no new evidence to suggest that permanent immunity to measles can be developed except by experiencing a clinical case of that disease. Newly described diseases and syndromes present a field of new epidemiological problems. Most of them have at least an indirect connection to the war and its effect on normal civilian life. Pandemic influenza stumped the investigators in the last war, but this time we are still struggling with the problem of the milder atypical pneumonia. Epidemic keratoconjunctivitis in industrial workers poses new problems, as does the unexpected appearance of jaundice among those receiving certain lots of yellow fever vaccine. Tropical diseases have jumped to first place in military medical interest and the epidemiology of these diseases has received an equal stimulus. Concomitantly, new facts are being discovered as to the behavior of temperate zone diseases introduced by military personnel into the tropical climates. Investigators have the opportunity to follow the streptococcus or diphtheria bacillus carrier rates in the tropics and to determine whether the clinical infections become attenuated eventually, after introduction from the north. The sulfonamide

drugs of course have put new control measures in our hands. Chemoprophylaxis rather than chemotherapy is more within the epidemiologist's sphere.

In regard to meningococcus meningitis, here are our present ideas on the subject. Even in epidemic times the distribution of the disease is spotty and sporadic with little direct contact from case to case. This is attributed to the high ratio of carriers to cases, which in turn may be due to the relative scarcity of individuals who are susceptible to blood stream or central nervous system invasion. Special environmental factors, leading to development of clinical meningococcal infection are suggested by the age and sex distribution of the disease, not only the expected childhood peaks but also a preponderance in adult males which may mean that exposure and fatigue play their part. Like the other infectious diseases a continuous addition of susceptibles to the population, as at boot camps, helps fan the flames of the epidemic but as the annual reports have shown, a case or two is all that is to be expected in the relatively static population of a naval vessel at sea. Studies at naval training stations and army camps have indicated that there is a relationship between carrier rates for meningococci and the number of cases occurring in the population. The relationship is more striking when the carrier rates for the epidemic Type 1 meningococcus are considered against the number of cases. One gram of sulfadiazine a day throughout the period of recruit training is sufficient to eliminate the meningococcus carrier state and apparently has had its effect on the meningitis cases.

5. Since epidemiology is the study of the mass-phenomena of disease in its natural surroundings, the laboratory approach is only one part of the problem. Effective contact and resulting infection are hindered or favored by forces in the complex human environment. Housing, nutrition, medical care, economic, sociological, and historical considerations are all demanded in the consideration of the natural surroundings of disease. This approach perhaps applies more to civilians than to military epidemiology. In general, English workers have been well ahead of the Americans in the study of these social and economic factors and their effect on the distribution of disease.

6. Through all these approaches runs the thread of the statistical method or the quantitative approach to medical problems. This is not a new approach, though fashions in statistical techniques may change from Chi square to standard error and now towards variance analysis. The basic information we want and the questions we ask are the same though the sources begin to show improvement. Today, morbidity reports from certain places are reliable enough to be used for analysis whereas not so long ago all we had were mortality figures, and the dubious device of drawing conclusions about cases from the number of deaths reported.

What we hope now is to extend the foundations of quantitative medicine so that medical students will be inculcated with this technique and point of view. It seems the only way to diminish the bulk of medical literature depending on clinical impression and pre-formed opinions rather than controlled observations. The testimony of Lavoisier³ in the investigation of Mesmer expressed this better than I have ever seen it:

The art of drawing conclusions from experiments and observations consists in estimating probabilities and gauging whether they are sufficiently great and numerous to constitute proof. This kind of calculation is much more intricate and difficult than is thought; it calls for great sagacity and is generally beyond the powers of the ordinary man. It is mistakes of this kind of calculation that give an opening for the success of charlatans, sorcerers, and alchemists, and, in the past, of magicians and enchanters and generally, all those who labor under illusions themselves or seek to exploit the credulity of the public.

In medicine the difficulty of gauging probabilities is particularly great. Since the principle of life in animals is a force which is ever active, which is constantly endeavoring to overcome obstacles, and since nature when left to its own devices, cures many diseases by itself, it follows that, when a remedy is applied, it is infinitely difficult to determine what effects are due to nature and what to the remedy. The result presents itself to the wise man merely as a greater or lesser degree of probability, and that probability can be converted into certainty only by a large number of facts of the same kind.

7. The final consideration is concerned with our present ideas as to how epidemiology should be organized and the most efficient way for the coordination of the epidemiologist's work. It is an applied science based directly on observations in the field, the laboratory and the bedside. Without adequate support from the clinical laboratory the field aspects of these problems in mass-medicine are inadequately handled. With such a broad approach the activities of a team rather than an individual are demanded; and the team must be trained to work together for the coordination of the contributions of all its members. The Navy, I believe, sees the problem from this point of view and for that reason has supported the program for the training of epidemiologists, and has sent them out in units for disease prevention and the control of epidemics in the various naval activities.

Originally, I had meant to enclose a copy of the discussion and summary from the paper we are writing on respiratory disease at the Newport Naval Training Station but the letter is already so bulky it had perhaps best be left out.

Very sincerely yours,

STAFFORD M. WHEELER
Lieutenant (MC) USNR

³ LAVOISIER, A. L.: *Mémoire sur le Magnétisme Animal* (1784), in (*Œuvres de Lavoisier*, Paris, 1865, vol. 3, p. 509.

DERMATITIS DUE TO THE PREPARATION AND ADMINISTRATION OF PENICILLIN SOLUTION

WILLIAM C. MARSH
Commander (MC) U. S. N.
and
WILLIAM N. NEW
Commander (MC) U. S. N.

IN THE past 4 months 8 cases of contact dermatitis caused by the preparation and administration of penicillin solutions have been noted at the United States Naval Hospital, Philadelphia, Pa.

Reports of contact dermatitis from the preparation of penicillin among physicians and technicians have appeared in recent medical literature. Pyle and Rattner (1) gave a short summary of the case of a physician. Silvers (2) reported a case of a chemist who developed contact dermatitis while he was handling amorphous sodium penicillin. Binkley and Brockmole (3) observed two physicians with contact dermatitis from penicillin.

That penicillin is a sensitizing substance has been proved by numerous investigators by means of patch tests with penicillin. The widespread use of penicillin will probably cause an increase in the number of cases of contact dermatitis.

CASE REPORT

D. P. E., PHM1/c, a 21-year-old white male, reported in May 1947, with an erythematous-vesicular eruption involving the lateral aspects of the fingers and the palms of both hands (fig. 1). He also had erythema and scaling of the eyelids, face, and ears. He had been preparing and administering penicillin solutions for the past 8 months and his dermatitis was of 2 months' duration. There had been no previous penicillin therapy. He had been under treatment for the previous week for "dermatophytids" of the hands with little improvement in his condition. The history revealed that while on 2 weeks' leave, with no treatment, the dermatitis had improved, only to have an exacerbation of his condition on return to duty on his ward. He was patch tested on the forearms with penicillin solution and ointment. The ointment gave fine vesicles on an erythematous base (two plus), with the vesicles disappearing within 1 week. The penicillin solution on the left forearm gave a marked erythematous-vesicular eruption in 10 hours, at which time the patch was removed because of intense pruritus (fig. 2). Twenty-four hours later bullae developed and an erythema approximately twice the size of the original patch test was present. In addition, there was exacerbation of the hand lesions with the formation of new vesicles and bullae and a



Figure 1.—*Appearance of the hands prior to therapy. Note vesicles, bullae, and rather marked desquamation of the hands. Patient later had desquamation of the entire surface of both palms.*

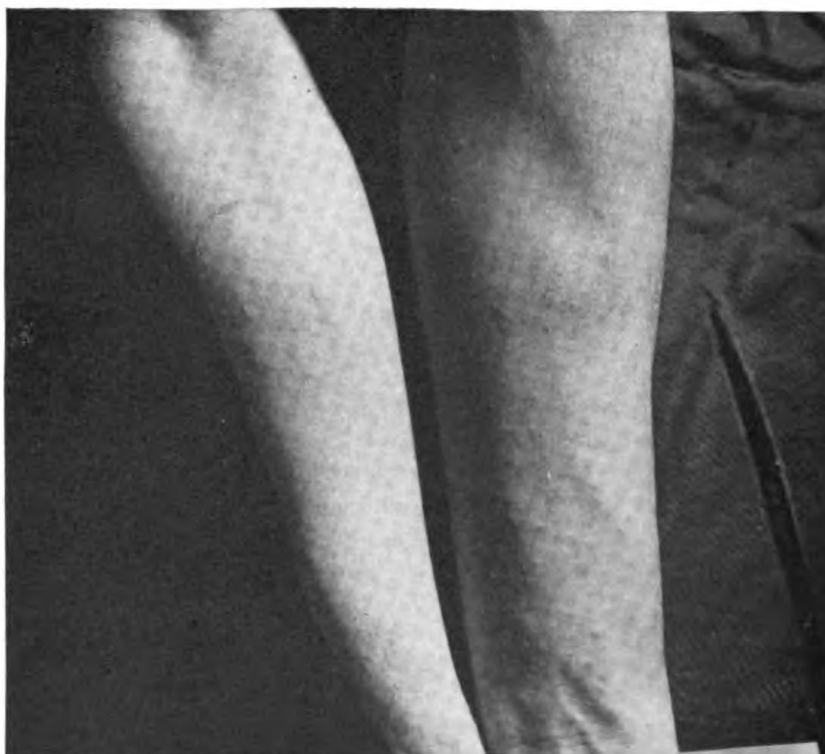


Figure 2.—*On the right forearm, patch test with penicillin ointment (2+). On the left forearm, penicillin solution (4+). Notice papulovesicular eruption of the volar aspect of left forearm that appeared with the application of the patch test.*

papulovesicular eruption of the volar aspect of the left forearm. With Burow's soaks and bland ointments his condition improved rapidly, and with the avoidance of penicillin there has been no recurrence to date.

A review of the histories of the seven remaining cases revealed improvement on week ends, hospitalization, leave, and duty not involving the preparation and administration of penicillin. In addition to the involvement of the hands, two cases had an erythematovesicular eruption of the face. These two patients had the habit of brushing their faces frequently with the hands. Duration and amount of exposure apparently had no relation to the onset and severity of the dermatitis. The most extensively involved case had been exposed almost constantly for the past 6 months, while moderate involvement was seen in cases exposed 3 months and 2 years respectively. Only one of these seven had received previous penicillin therapy, and this without reaction from parenteral administration.

The patch tests with penicillin ointment and solution were performed according to the procedure recommended by Schwartz and Peck (4). The commercial crystalline penicillin sodium was dissolved in isotonic sodium chloride solution (10,000 units per cc.); and 500 units were used per gram, in equal parts of lanolin and petrolatum, for the ointment. Reactions varied from 1 to 4 plus within 24 hours, being more positive in each instance with the penicillin solution. Subsequently, penicillin solution was given parenterally to four of these patients with no reactions.

COMMENT

The treatment is relatively simple in that Burow's solution (solution of alum, 5 parts, and lead acetate, 25 parts, dissolved in 500 parts of water) 1:10 or boric acid as soaks and a bland ointment will produce a rapid and marked improvement. The patient should avoid all further exposure to penicillin.

The diagnosis and treatment of vesicular eruptions of the hands have always been difficult. With passage of time and dermatologic investigation fewer cases are now being diagnosed as recurrent vesicular eruption, or as nummular exzema. The close similarity of all our cases to dermatophytids (ids),¹ of the hands was striking, and in the case reported pompholyx was seriously considered.

It is our opinion that contact dermatitis (penicillin) does not contraindicate subsequent parenteral penicillin therapy. While four cases in this series were given one injection of penicillin without reaction, none of the eight has been given parenteral penicillin over any extended

¹ Allergic eruptions, secondary to cutaneous mycoses, are "termed dermatophytids, trichophytids, microsporids, favids, monillids, *et cetera*, each organism forming its own 'id.'"—ANDREWS, G. C.: *Diseases of the Skin*. 2d edition. W. B. Saunders Co., Philadelphia, Pa., 1939. p. 299.

period of time. In the future, if any such cases require parenteral penicillin, the reactions to penicillin should be reported especially if there is a recurrence of dermatitis of similar nature and distribution.

In any instance of a vesicular eruption of the hands and especially if associated with erythema, scaling or vesicles of the face, in a physician, nurse or corpsman who is preparing and administering penicillin, the diagnosis of contact dermatitis (penicillin) should be considered. Patch tests should be performed in all such cases. It is also imperative that minimum contact with the solution should be practiced in the preparation and administration of penicillin.

SUMMARY AND CONCLUSIONS

1. A series of eight cases has been observed, all proved to be contact dermatitis due to the preparation and administration of penicillin.

2. Physicians, nurses, and hospital corpsmen who prepare and administer penicillin solutions and develop a vesicular eruption of the hands should be considered as having a contact dermatitis until proved otherwise.

3. Care should be used in the preparation and administration of penicillin solutions.

4. The widespread use of penicillin will result in an increase in the cases of contact dermatitis.

5. Suggested materials for patch testing suspected cases are given.

6. There is no evidence that contact dermatitis contraindicates subsequent parenteral penicillin therapy. Future observation of reactions in such cases should be carefully observed, especially if there is a recurrence of the dermatitis.

REFERENCES

1. PYLE, H. D., and RATNER, H.: Contact dermatitis from penicillin. J. A. M. A. 125: 903, July 29, 1944.
2. SILVERS, S. H.: Contact dermatitis from amorphous sodium penicillin. Arch. Dermat. & Syph. 50: 328-329, Nov. 1944.
3. BINKLEY, G. W., and BROCKMOLE, A.: Dermatitis from penicillin; report of 2 cases. Arch. Dermat. & Syph. 50: 326-327, Nov. 1944.
4. SCHWARTZ, L. (Washington, D. C.), and PECK, S. M.: Patch test in contact dermatitis. Pub. Health Rep. 59: 546-557, Apr. 28, 1944.



PTERYGIUM: A SIMPLE EFFICIENT METHOD OF TREATMENT

HENRY G. BULLWINKEL
Captain (MC) U. S. N.

PTERYGIUM is a term applied to a form of conjunctival pathology which is familiar to most physicians when they observe it on the eye of a patient but which has been difficult of exact definition.

May (1) offers the following description: a triangular fold of membrane, occupying the interpalpebral fissure, extending from the inner or outer part of the ocular conjunctiva to the cornea; the apex is immovably united to the cornea and is usually blunt; the base spreads out and merges with the conjunctiva.

Fuchs (2) makes essentially the same definition though enlarging somewhat upon it. The most comprehensive definition the writer has yet encountered is that of Dr. Sabri Kamel (3) of Cairo, Egypt, who states:

A true pterygium is a pathological encroachment of part of the bulbar conjunctiva exposed in the palpebral fissure over the cornea. This encroachment is in the form of a fold of the conjunctiva, triangular in shape, with the apex, called the head, on the cornea, the base merging imperceptibly in the caruncle region, or the region of the outer canthus, and the sides formed of two folds of the conjunctiva, an upper and a lower. This shape is not pathognomonic because if you pull the conjunctiva towards the cornea from any point near the limbus it forms a triangular fold quite identical with a pterygium. The clinical appearance of the pterygium differs according to the stage in which it is seen and according to the degree of activity of the process that leads to its formation. Thus in its active and progressive stage the fold is hyperaemic with dilated and congested radially disposed blood vessels, usually two or three in number, and the fold looks thickened, opaque and less translucent than the surrounding conjunctiva. In the meantime, surrounding the advancing head over the cornea, a halo of greyish white opacity is seen, with its convexity toward the center of the cornea. This halo of opacity is denser near the head of the pterygium and fades away towards the center of the cornea. It is quite superficial being present in the epithelium and Bowman's membrane, and is composed of greyish white dots mostly aggregated at the points where the ciliary nerves pierce Bowman's membrane. This appearance of the clinical aspect of progressive active pterygia differs according to the amount of the activity of the case. But it is always noticed that the more hyperaemia and congestion of the conjunctival vessels, the denser is the halo of opacity in the cornea and the more progressive is the pterygium. Sooner or later, the condition begins to subside, the process being more or less self-limiting, and the regressive stage is reached in which the halo of opacity in the cornea

preceding the advancing head of the pterygium stops short and begins to become absorbed and the hyperaemia and engorgement of the conjunctival vessels begins to abate. Finally the atrophic stage is reached in which no halo of opacity is seen in the cornea, the head of the pterygium thins out and becomes cicatrized, the engorgement of the conjunctival vessels disappears nearly completely and the fold of the conjunctiva in general becomes more translucent than before but still less than the surrounding normal conjunctiva.

Etiologically, pterygium seems to start as a chronic irritative exposure conjunctivitis. Having started, two courses may follow: First, the condition may be limited to the conjunctiva only and not involve the cornea. Three stages ensue: (a) active, (b) regressive, (c) atrophic. There is thinning of the epithelium, increased deposits of connective tissue in radial bands, and hyaline and elastic tissue degeneration. With subsidence of the active process, what is left behind resembles pinguecula.

Second, if the chronic inflammation which has started in the conjunctiva involves the cornea, a true pterygium is formed. Why this latter should happen is not yet entirely clear unless, as Mann (4) puts it, "Pterygium has been known to be hereditary."

Pathologically, pterygia have been considered to be neoplastic in origin. Williamson-Noble and Sorsby (5) have so listed them. McReynolds (6) described it as a "simple benign primary growth." Kamel seems to refute conclusively the neoplastic argument.

The theory that the pterygium is a degenerative condition is largely accepted today. Kamel does not concur in this; he states that most proponents of this theory mean a primary type of degeneration, and it is his opinion that one sees a postinflammatory form in pterygia.

Some investigators have compared pterygium with pannus degenerativus. Kamel disagrees, stating "while in pannus degenerativus the pathological changes that occur in the cornea invite a limbic vascularization, in the case of pterygium, a whole fold of the conjunctiva is invited to encroach." He concludes that it is only when the conjunctiva and the cornea are *simultaneously* affected, with the deposition of new formed subepithelial tissue bands in both, that through the contraction of this fibrous tissue a pterygium is formed.

Surgically, Kamel's technique (3) is very simple. Atrophic cases are left alone or operated at once. Progressive cases are treated for about 2 weeks with cleansing, soothing drops and ointments before operating.

At operation, after preparation and insertion of the speculum, the neck of the pterygium, over the limbus, is picked up with fixation forceps. The head of the pterygium is well shaved from its corneal attachment. The pterygium is well undermined up to the caruncle with fine strabismus scissors. The fold of undermined tissue is raised from the sclera and its undersurface cauterized with carbolic acid by means

of a wooden toothpick. This phenolized tissue dries almost immediately and is replaced. Because of the drying, burns of the sclera do not occur. No sutures are used. Care is taken not to cauterize the surface of the sclera. A small amount of ophthalmic ointment—boric acid or mild mercurial—is put in the lower cul-de-sac. The eye is dressed daily with one-half percent zinc sulfate eye drops and the ointment. After the fourth or fifth day the bandage is discarded and the drops and ointment continued for another 10 to 20 days.

Kamel summarizes by reporting 600 cases over a 6- to 7-year period without a single recurrence.

The writer had operated upon a small number of pterygia with apparently the average results and was hardly more than casually interested in the subject until October 1946 at which time he reported for duty at American Samoa. This island, an ophthalmologists paradise (as well as a story-writer's) has an extraordinarily high incidence of pterygia among its natives. It is very common here for a native to present himself at the eye clinic with four simultaneously active pterygia; that is, nasal and temporal "growths" on each eye. When first examining these patients one learns that they have been operated on once, or even twice before and that the present visit represents a recurrence. Being new and fresh on the island one enthusiastically operates upon these cases, both recurrent and new, and is chagrined to find that one gets a far higher proportion of recurrences than one had in the United States. The question arises as to the cause for this much higher rate of recurrences, the surgical technique remaining the same.

The natives are exposed to the sun a great deal and in dry spells clouds of dust do irritate the conjunctival mucosa. This dust, volcanic in nature, seems to be particularly irritating. Yet the caucasians (U. S. naval personnel) on duty there do not seem to be affected. This can hardly be explained on a basis of time. It is true that most of the naval personnel have a tour of duty of from 1 to 2 years, yet there are a fairly large number of white civilians who remain for years without a single case of pterygium among them. The writer feels that in this particular environment the cause of the higher incidence is racial. Anthropologists like Keesing of Stanford University insist that Polynesians are a separate race, distinct from Caucasians and Negroes. Yet the writer has found on examining innumerable Samoans with the ophthalmoscope that every one had a typical negroid fundus. Then, too like the Negro, the Samoan is very prone to develop keloids, postoperatively. In like manner his conjunctiva seems to react more violently to the irritative volcanic dust than does the white man's. In retrospect one would have liked to have used the method of Kamel on these cases.

Since returning to the United States the writer has used this extremely simple method on three cases at the U. S. Naval Hospital, Brooklyn, N. Y., and in each instance a perfect result was obtained without recurrence.

This method and report is submitted to the members of the Medical Corps of the Armed Services. It can be employed by any medical officer in the service, not necessarily an ophthalmologist, in the States, on shipboard, or in isolated far-flung outposts where trained eye men may not be available.

REFERENCES

1. MAY, C. H.: *Manual of Diseases of Eye for Students and General Practitioners*. 17th edition, revised. Williams & Wilkins Co., Baltimore, Md., 1941. p. 139.
2. FUCHS, A.: *Text Book of Ophthalmology* (Duane). 8th edition. J. B. Lippincott Co., Philadelphia, Pa., 1919. pp. 449-500.
3. KAMEL, S.: Pterygium; its nature and new line of treatment. *Brit. J. Ophth.* **30**: 549-563, Sept. 1946.
4. MANN, I.: *Developmental Abnormalities of Eye*. Published for *Brit. J. Ophth.* The Macmillan Co., New York, N. Y., 1937. p. 389.
5. WILLIAMSON-NOBLE, F. A., and SORSBY, A.: Etiology of eye diseases; developmental defects; heredity. In BERENS, C.: *The Eye and Its Diseases*. W. B. Saunders Co., Philadelphia, Pa., 1936. Ch. 29, p. 314.
6. McREYNOLDS, J. O.: Surgery of orbital cavity. In BERENS, C.: *The Eye and Its Diseases*, W. B. Saunders Co., Philadelphia, Pa., 1936. Ch. 60, p. 1160.



STREPTOTHRICOSIS

Report of a Case With Recovery

WALTER L. SCHAFER
Commander (MC) U. S. N. R.

BELONGING to that order of micro-organisms standing midway between the true bacteria and the more complex molds is *Streptothrix*. This order is designated by Bergey (9) as *Actinomycetales* and comprises two families, the *Mycobacteriaceae* (including the tubercle bacillus and related bacteria) and the *Actinomycetaceae*. The latter family includes those forms which have septate and branched mycelia and reproduce by the formation of aerial spores (conidia). It is composed of numerous genera and species whose terminology is greatly confused. Zinsser and Bayne-Jones (1) believe that an accurate subclassification is impossible at this time. They employ the generic term *Leptothrix* to include all the unbranched forms and the generic designation *Actinomyces* for all the branched forms. Attempts to subclassify the latter genus have led to great confusion.

Typical *Actinomyces bovis* which gives rise to clinical actinomycosis is anaerobic and forms clubs when it grows in tissues; hence the characteristic sulfur granule and the term "ray fungus" (2). "Streptothrix" has been employed to designate strains without characteristic clubbing. Other differentiation of species have been based on anaerobic or aerobic growth (3).

The reported streptothrix infections, unlike actinomycosis, have rarely involved the head and neck (4). According to Strong (4), all patients in which a streptothrix of this type has been demonstrated from the lung or sputum have died. Such cases are not common and when they do occur resemble tuberculosis both clinically and pathologically. The lesions are exudative and generalize rapidly, and there is a tendency toward rapidly fatal pyemia and metastases, usually to the brain. The clinical picture thus resembles tuberculosis but the lower lobes of the lungs are more frequently involved (5) (6). The positive diagnosis depends upon the demonstration of the fungi in the sputum.

A case of pulmonary disease caused by an atypical organism of the genus *Actinomyces* was recently studied aboard the U.S.S. *Benevolence* in the Tokyo Bay area of Japan.

CASE REPORT

A 28-year-old seaman, first class, was admitted to this hospital ship on 20 September 1945 complaining of (1) loss of weight, (2) productive cough, and (3) weakness.

The onset of these symptoms was approximately 3 months prior to this admission when patient first noticed that he was losing weight. Shortly thereafter, he developed a productive cough with thick, dark green, foul-smelling sputum, totaling about 150 cc. in 24 hours. This was repeatedly negative for acid fast bacilli.

For 6 weeks prior to admission he had intermittent attacks of hoarseness becoming progressively worse with each seizure and the last week had pain in his left chest on coughing or with deep respiration. In spite of these symptoms this man remained on duty without feeling especially ill until admission to sick bay on his ship 5 days before transfer here.

The following positive findings were noticed before transfer:

- (1) Hoarseness.
- (2) Dyspnea during conversation.
- (3) Consolidation in the left lung.
- (4) Marked weight loss.

The patient had worked in a coal mine for 4 years prior to entering the naval service, had had scarlet fever and typhoid at age 9 and the usual childhood diseases. He also states he had had pneumonia five times before he was 10 years old. The family history was noncontributory. The only time this patient had been ashore since leaving the United States was in Panama and Leyte. He admitted sexual intercourse once in each place followed by adequate prophylaxis. Further questioning did not reveal any evidence of venereal infection.

Admission examination revealed a malnourished white male with a temperature of 101.2° F., showing evidence of recent loss of weight. There was a moderate gingivitis present with several small white ulcers on the soft palate. Expansion of the chest was normal and equal on both sides. Some dullness was found over the left lower lobe with bronchial breathing, whispered pectoriloquy and consonating râles. Tactile fremitus was increased over both sides of the chest, and a few fine râles were heard in both bases. The rest of the physical examination was essentially negative.

Immediate laboratory studies of the blood and urine were normal except for a mild anemia, a sedimentation rate of 27 mm. per hour (Cutler), and a strongly positive Kahn reaction. An x-ray of the chest showed a diffuse exudative process in the left middle and lower lung fields (fig. 1). The sputum examination was negative for acid fast organisms. The Kahn was strongly positive (12 plus) on four specimens of blood taken during the patient's hospitalization. A laryngoscopic examination early revealed moderate thickening of both arytenoids, of the interarytenoid region and of both cords without ulceration. A repeat laryngoscopic examination before discharge showed marked improvement. The sedimentation rate remained elevated throughout the disease.

Sulfadiazine, 1 gram every 4 hours, was started immediately. Although the patient became afebrile in 2 days his general condition was unimproved, and the chest findings seemed more extensive. He was then given 500 cc. of whole blood, and treatment with penicillin was started, using 20,000 units every 3 hours. Three days later the chest film did not show any change. The penicillin dosage was increased to 40,000 units every 3 hours and, clinically, the patient began to improve.

Ten days after admission a pure culture of streptothrix was isolated from the sputum. The organism was described as having branching and septate

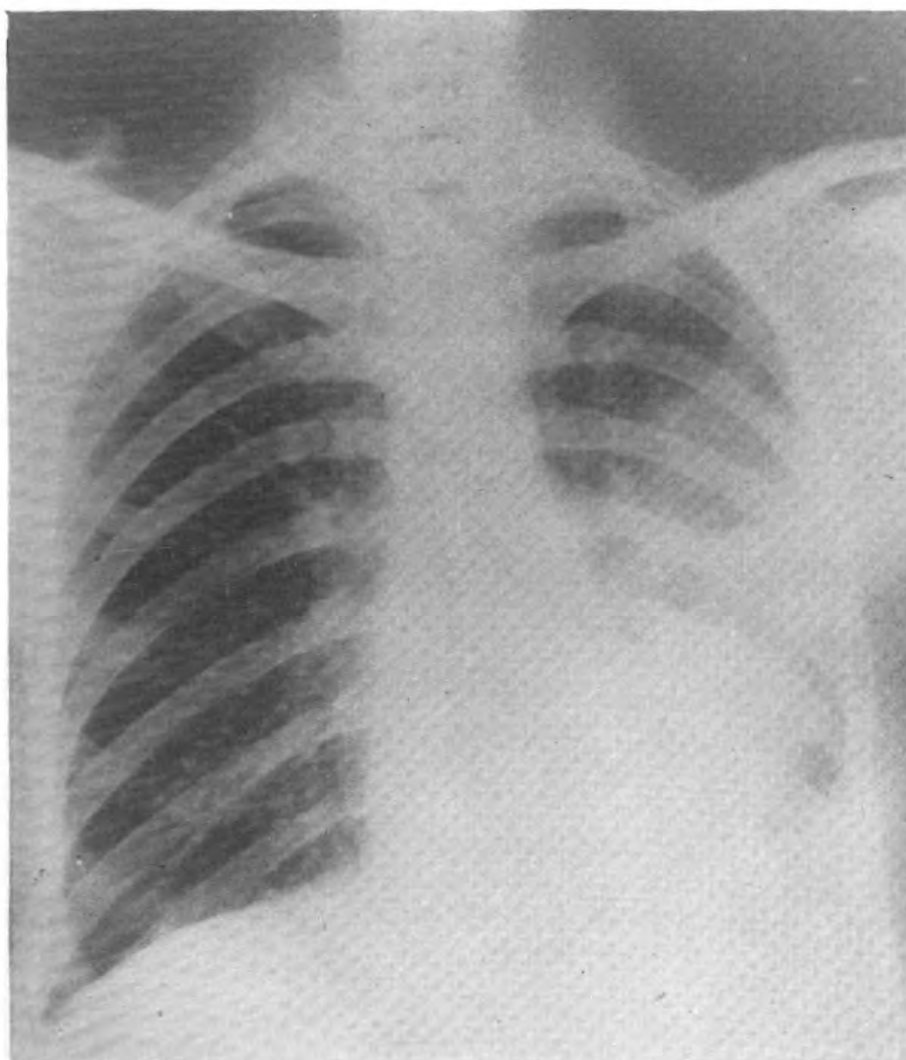


Figure 1.—*X-ray on 20 September 1945 showing soft infiltration of left middle and lower lung fields.*

mycelia without the clubbing characteristic of *actinomyces bovis*. No sulfur granules were seen. The ability of this fungus to grow anaerobically was not investigated.

The patient continued to improve clinically and repeated x-ray plates (figs. 2 and 3) showed gradual clearing of pneumonic process.

Penicillin was discontinued on the 25th day, after a total of 4,160,000 units and 56 grams of sulfadiazine had been given. At that time there were occasional moist râles throughout the chest. There were 8 cc. or less of sputum per 24 hours.

Potassium iodide was administered in graduated doses. Twenty drops three times daily were given at the time of transfer. Five weeks after admission x-ray evidence of the lesion in the left lung disappeared. The patient was up and about after the sixth week and rapidly regained his strength and appetite. He had gained 13 pounds by the time he was evacuated to the United States on 12 December 1945.

At that time he was asymptomatic and there was almost complete resolution of the pneumonic process (fig. 3). Because of the possibility that streptothricosis might be responsible for the positive serology and in view of a negative history of syphilitic infection, this patient was evacuated to the nearest U. S. naval hospital in the United States where he could have the advantage of a Kolmer-Wassermann test and colloidal gold studies of the spinal fluid before a coexistent diagnosis of syphilis could be made.

DISCUSSION

The differentiation of streptothricosis from actinomycosis is difficult by laboratory methods, and a clinical differentiation is even more so. In this case the clinical signs and symptoms in the early part of the disease suggested tuberculosis and later suggested fungus disease of the lung. After tuberculosis had been ruled out, actinomycosis

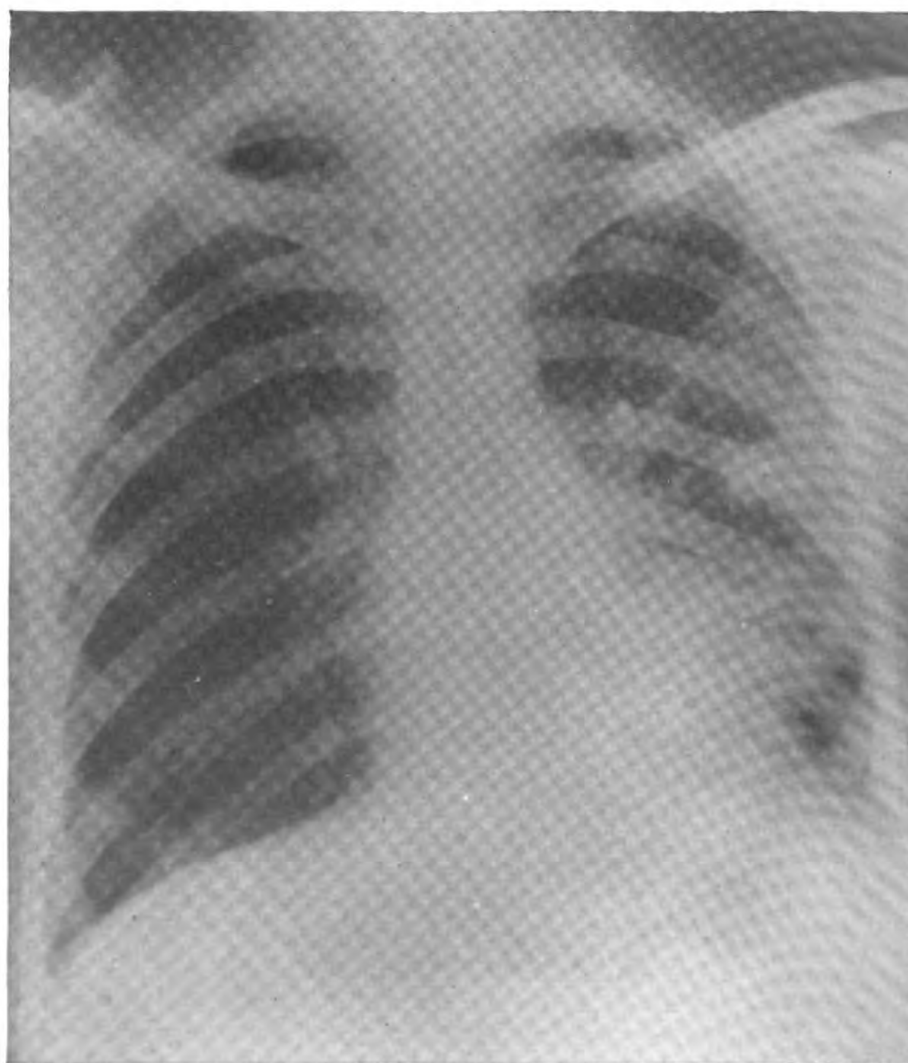


Figure 2.—X-ray on 1 October 1945 showing beginning resolution of the process with a suggestion of small cavities in middle lobe.

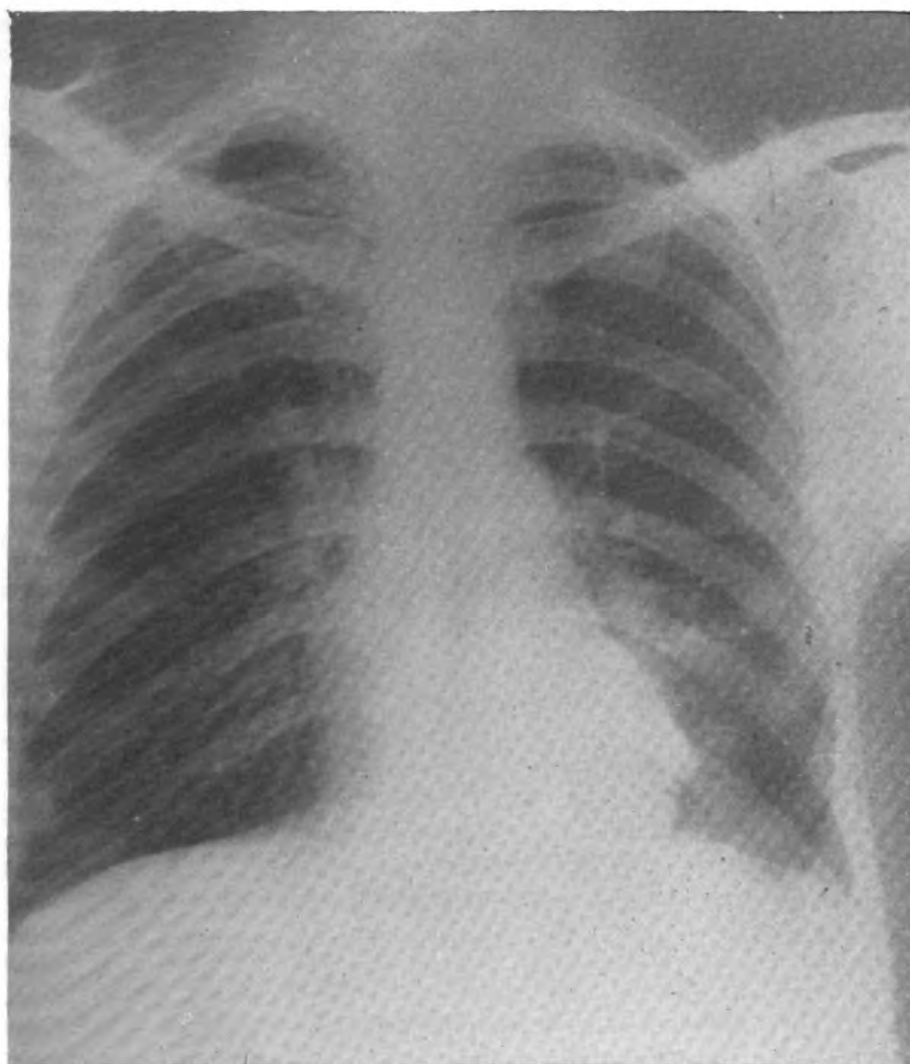


Figure 3.—Final x-ray on 12 November 1945 showing almost complete resolution with residual fibrosis in the left lower and middle lung fields.

of the usual type was suspected but there were no oral, cutaneous, or gastro-intestinal lesions. Culture of the fungus revealed an organism without clubbing, without sulfur granules, and with branching mycelia characteristics of streptothrix. The disease was therefore classified as streptothricosis.

A point of secondary interest was the fact that the positive Kahn (12 plus) which the patient had on admission remained heavily positive (12 plus) throughout the course of the disease in spite of 4,160,000 units of penicillin therapy in 25 days. According to Turner (7) and others (8), during serologic testing for syphilis most false positive reactions are attributable to one of three causes: (1) technical, (2) general biological, and (3) diseases other than syphilis.

The positive serology obtained in this case may fall in the third group. Turner mentions malaria, rat bite fever, relapsing fever,

leishmaniasis, trypanosomiasis, typhus fever, infectious mononucleosis, leprosy, and immunization against smallpox and typhoid. He also includes acute respiratory diseases such as nonspecific pneumonia, but makes no mention of fungus diseases of the lungs. It is probable, from observation of this case, that streptothricosis may also produce a positive serological reaction.

SUMMARY

1. The clinical findings and course of a case of streptothricosis have been described.
2. Recovery with the combined use of penicillin and sulfadiazine occurred within a period of 7 weeks.
3. No clinical complications were observed.
4. The Kahn was positive in high titer in the absence of any luetic signs or symptoms. This may have been due to a nonspecific reaction induced by the infection.

REFERENCES

1. ZINSSER, H., and BAYNE-JONES, S.: *Textbook of Bacteriology*. 8th edition, revised. D. Appleton-Century Co., New York, N. Y., 1939.
2. JORDAN, E. O., and BURROWS, W.: *Textbook of Bacteriology*. 13th edition revised. W. B. Saunders Co., Philadelphia, Pa., 1944.
3. STITT, E. R.; CLOUGH, P. W.; and CLOUGH, M. C.: *Practical Bacteriology, Haematology and Animal Parasitology*. 9th edition revised. Blakiston Co., Philadelphia, Pa., 1944.
4. STRONG, R. P.: *Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases*. 6th edition. Blakiston Co., Philadelphia, Pa., 1943.
5. YATER, W. M.: *Fundamentals of Internal Medicine*. 2d edition. D. Appleton-Century Co., New York, N. Y., 1944.
6. KARSNER, H. T.: *Human Pathology*. 6th edition, revised. J. B. Lippincott Co., Philadelphia, Pa., 1942.
7. False Positive Reactions in Serologic Tests for Syphilis. *BuMed News Letter* 1: No. 9, 19, Friday, June 25, 1943.
8. Biologic False-Positive Serologic Tests for Syphilis. *BuMed News Letter* 5: No. 5, 17-18, Friday, March 2, 1945.
9. BERGEY, D. H.; BREED, R. S.; MURRAY, E. G. D.; and HITCHENS, A. P.: *Bergey's Manual of Determinative Bacteriology*, 5th edition. The Williams & Wilkins Co., Baltimore, Md., 1939.



PROLONGED LABORATORY OBSERVATIONS ON CLINICAL CASES AND CARRIERS OF "SHIGELLA FLEXNERI III" FOLLOWING AN EPIDEMIC

FRANK R. PHILBROOK
Commander (MC) U. S. N.

LA VERNE A. BARNES
Commander (MSC) U. S. N.

WILLIAM J. McCANN, JR.
Lieutenant, junior grade (MC) U. S. N. R.

and

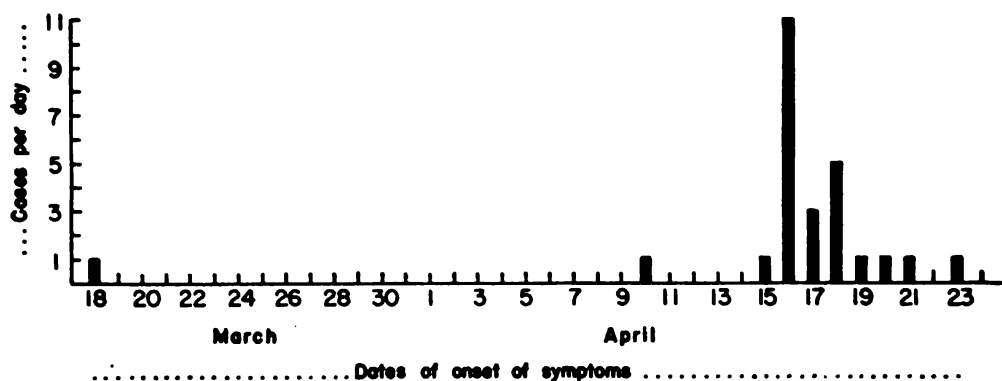
RUSSELL R. HARRISON
Ensign (HC) U. S. N.

IN APRIL 1947 an epidemic of bacillary dysentery occurred on the U. S. S. *Duluth* while the vessel was in Pearl Harbor. From the ship's company of 905 officers and men there were 25 clinical cases of the disease that were subsequently admitted to the U. S. Naval Hospital, Aiea Heights. The epidemic curve is presented in figure 1. During investigations of the outbreak by Epidemiology Unit No. 106, 59 asymptomatic carriers of the etiologic agent were found and all of these were also transferred to the hospital. The case attack rate, therefore, was 2.8 percent and the detected asymptomatic carrier rate 6.5 percent, resulting in an observed infected rate of 9.3 percent. The clinical cases were hospitalized upon the basis of clinical signs and symptoms while the admission of carriers was based upon the results of three rectal swab cultures taken from the entire crew on three successive days. It is the purpose of this communication to make a report of the results of laboratory observations made upon these two groups over an extended period of time and to attempt interpretations of some of the implications that developed from the studies.

In general, all clinical cases exhibited a symptom complex of abdominal cramps, watery diarrhea, malaise and a mild febrile reaction. Several of the patients were nauseated, some vomited and a few experienced vertigo. The diarrhea, which was present in 95 percent of the cases, varied in frequency from several bowel movements to a maximum of more than 30 per day; in only four cases was gross blood observed

in the stools. Two-thirds of the patients suffered marked generalized malaise accompanied by headache. About one-half of the clinical cases ran a low grade fever which, except in three cases, did not exceed 100° F. In one instance fever was the only subjective symptom and a temperature of 102° F. was reached.

In 24 of the 25 patients, the clinical diagnosis was confirmed by laboratory procedures including from one to three rectal swab specimens followed by isolation of the causative organism and subsequent biochemic and serologic identification. *Shigella flexneri III* was found in all but one of the 25 cases. Identification of representative strains of these organisms was confirmed by the Bacteriology Facility, Naval Medical Research Institute, Bethesda, Md. Serums from 11 of the patients taken approximately 6 weeks and again about 3 months following the onset of symptoms, agglutinated the causative organisms in dilutions ranging from 1:320 to 1:5120, the latter being the maximum dilution used. With one exception, all titers were 1:1280 or higher; the single exception was the one individual from whom *S. flexneri III* was not recovered despite the onset of symptoms typical of the disease at the height of the epidemic.



Symptomatic treatment of the clinical cases consisted of a rice, banana and tea diet; paregoric was given in 4-cc. doses after each bowel movement to a maximum of 24 cc. per day. Fluids and enteric salt tablets were administered to those with clinical evidence of dehydration; only one case required intravenous fluids.

Attempts at "specific" therapy first consisted of the concomitant administration of streptomycin and sulfaguanidine. Streptomycin was given orally in divided doses of $\frac{1}{8}$ gram in 2½ cc. of water every 4 hours for four daily doses over a period of 3 days, thus making a total of 1½ grams of the drug. The initial dose of sulfaguanidine was 6 grams and this was followed by 3 grams every 4 hours thereafter for 7 days resulting in a total of 210 grams. Subsequently, the

Alternation of positive and negative phases

Cultural phases																Totals			
Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Cultures	Days	Phases				
															Pos.	Neg.			
1/1	2/6	1/1	11/17	1/1	3/3	1/1	1/3	4/6	1/1	4/6	1/1	9/13	106	146	20	19			
													32	58	2	2			
													68	86	0	41			
													65	89	1	42			
													56	76	0	41			
													49	69	0	41			
3/3	3/4	1/1	2/2	1/1	26/46								22	29	0	41			
													63	91	9	9			
													51	72	2	3			
													69	116	3	4			
													58	79	3	4			
													81	108	5	6			
													27	86	0	41			
													64	89	0	41			
													54	73	0	41			
													73	113	4	4			
													48	79	1	42			
													28	65	0	41			
													55	73	2	3			
													52	73	3	4			
													54	74	3	3			
													53	74	2	3			
													58	78	0	41			
													55	77	0	41			
													37	47	1	42			
1/1	3/3	1/1	23/31										90	127	4	5			
													82	112	3	4			
													80	107	8	9			
1/1	2/3	2/2	1/1	1/1	1/3	2/8	18/22						83	112	5	5			
1/1													86	108	1	42			
													107	144	11	12			
1/1	1/3	1/1	8/12	2/2	3/5	3/3							82	108	7	7			
													32	41	2	2			
													69	139	10	10			
													51	72	0	41			
													55	79	0	41			
5/5	2/5	2/2	2/4	1/1	7/11	7/9							25	55	0	41			
3/6	1/1	2/2	2/4	3/3	7/10	1/1	1/1						102	144	10	10			
													102	140	13	14			
													60	82	5	6			
1/1	23/31												63	87	2	3			
													84	114	7	8			
													17	23	2	3			
													53	73	1	42			
													54	73	4	4			
1/1	1/1	2/2	4/7	1/1	13/16	1/1	17/29						47	62	4	4			
													59	78	0	41			
													105	146	15	15			
													63	89	6	7			
													51	74	1	42			
													81	108	6	6			
													52	72	0	41			
													63	86	0	41			
2/2	1/1												83	114	7	8			
													59	79	0	41			
													62	82	3	4			
													54	75	0	41			
													27	36	0	41			
2/5	1/1	2/2	1/3	1/1	1/1	1/1	2/4						75	107	6	7			
													106	154	12	12			

of days in the phase.
criteria, but was not followed culturally for too long a

patients received a second course of streptomycin, $1\frac{1}{2}$ grams divided over 3 days, and a course of sulfadiazine consisting of 4 grams initially followed by 1 gram every 4 hours for 7 days. It is of importance to note that 16 strains of *S. flexneri III* recovered from 16 individuals arbitrarily selected from the whole group were found to be sulfonamide resistant in that they grew luxuriantly on nutrient agar containing varying amounts of sulfadiazine up to and including 10 mg. per 100 cc. of medium. It is recognized that the basic medium probably contained sulfonamide inhibitors and that in a more suitable medium the degree of drug resistance might have been appreciably higher; 4 of these strains subsequently were found to show normal growth in a medium containing 750 mg. of sulfadiazine per 100 ml. (1).

It is impossible to determine statistically the response of these 25 patients to the forms of "specific" therapy employed because there was no control group provided due to an effort to return the men to duty as rapidly as possible. It may be stated, however, that all cases felt subjectively improved and experienced marked decreases in the severity of diarrhea within 48 hours after initiation of streptomycin therapy regardless of the duration of the illness at that time.

Subsequent to transfer from the ship to the hospital, all 59 asymptomatic carriers of the etiologic agent of this epidemic were subjected to the same "specific" therapy as was given to the clinical cases. It was hoped that such treatment might result in an elimination of the carrier condition.

A third course of streptomycin was administered to 1 of the original cases and 6 carriers from whose rectal swab cultures *S. flexneri III* was repeatedly recovered over periods of 146, 144, 139, 144, 140, 146, and 154 days respectively. This third, and apparently effective, course of antibiotic therapy consisted of the daily administration of 1 gram of the drug intramuscularly together with 2 grams orally for 10 days, thus making a total dosage of 30 grams.

FOLLOW-UP STUDIES

Repeated rectal swab specimens for bacteriologic study were taken from 14 clinical cases and 46 asymptomatic carriers over varying periods up to a maximum of 154 days after completion of the second course of streptomycin; 11 cases and 13 carriers, from the original group of 84 individuals, were released to duty too early to be included in the series. Specimens from the 60 remaining individuals were cultured and examined for the presence of *S. flexneri III*; observations were made on an average of slightly less than 5 cultures per person per week.

The objectives of these studies were: (a) To observe the appearance of *S. flexneri III* in successive cultures from known infected individuals over a prolonged period; (b) to determine the effectiveness of the "specific" therapy, as described above, in eliminating the infective agent from the subjects; and, (c) to seek a satisfactory answer to the question of the number of negative rectal swab cultures that should be required for the release of persons infected with *S. flexneri III* organisms. In connection with the latter point, it is of interest to note that Van Gelder and his coworkers (2) reached the conclusion that, although it is difficult to establish a bacteriologic cure, 12 consecutive negative cultures might be considered a fairly adequate criterion.

Before describing the results of the studies, certain modifying factors should be mentioned. The group of individuals in the study was selected from the ship on the basis of one or more positives out of three routine rectal swab cultures. It became apparent from a cursory examination of the basic data, and from the analysis to follow, that three is a very small number of cultures to be used for the detection of persons harboring *S. flexneri III*; it appears highly probable, therefore, that many such individuals aboard the vessel were missed by the customary procedure used. It is possible, furthermore, that the inclusion in the study of those infected persons not detected might have had a significant influence on the results if such subjects possessed characteristics quite different from those that were actually admitted to the series. It should be emphasized also that a negative bacteriologic finding does not necessarily mean that the organisms were not present in the intestinal tract of the individual cultured. Those familiar with bacteriologic procedures recognize the fact that selection of colonies from primary isolation mediums plays an extremely important part in cultural results; it is frequently impracticable to carry through to final identification *all* of the suspicious bacterial colonies that develop on a favorable medium. Experienced laboratory personnel conducted the observations herein recorded and it is believed that the findings are reliable. Of even greater significance is the fact that frequently a series of positive cultures was observed to follow varying numbers of negative cultures; this observation provides further evidence of a periodic "shedding" of the organisms, perhaps from some focus in the intestinal tract. The data available, of necessity, present differences in length of follow-up and in regularity of culturing during the period of study. Different results might have been obtained had it been feasible to culture every individual 7 days per week rather than an average of 5 days per week. In the case of the 7 individuals who were followed throughout the entire study period, it was necessary for the purpose of statistical

analysis arbitrarily to terminate their experience when they were started on their third, and apparently curative, course of streptomycin.

Results.—One of the most important observations resulting from the extensive serial culturing of the group was an alternation of periods during which the cultures were either positive (positive phase) or negative (negative phase) for *S. flexneri* III. These data are presented in condensed form in table 1; a preliminary examination of these figures led to the establishment of the following standards for the inclusion of individuals as "adequately followed": (a) A minimum of 20 rectal swab cultures following the second course of streptomycin therapy; and, (b) a maximum follow-up period in days of twice the number of cultures, or a minimum average of a culture every other day. These criteria resulted in a sample of 12 clinical cases and 42 asymptomatic carriers which formed the group upon which statistical studies were made.

It was found that of this group of 54 subjects, 38 or 70.4 percent showed positive rectal swab cultures during the period considered. A difference in this respect was observed when the group was divided on the basis of the presence or absence of clinical symptoms. From table 2 it is noted that of the clinical cases 58.3 percent yielded positive cultures while 73.8 percent of the asymptomatic carriers were in this category. This difference is interesting and suggestive and it is difficult not to state definitely that it is statistically significant. Two possible sources of bias must be taken into account, however, in interpreting this observation; first, the average number of cultures was somewhat smaller for the ill (59.6) than for the well (66.5); and second, the number of clinical cases was small. The effect of these factors cannot be fully assessed.

TABLE 2.—Number and percent of cases and carriers showing one or more positive cultures after streptomycin therapy¹

Culture results	Cases		Carriers		Total	
	Number	Percent	Number	Percent	Number	Percent
Positive.....	7	58.3	31	73.8	38	70.4
Negative.....	5	41.7	11	26.2	16	29.6
Total.....	12	100.0	42	100.0	54	100.0

¹ A average number of cultures: cases, 59.6; carriers, 66.5.

Although it is not within the scope of this report to present a statistical evaluation of the therapeutic efficacy of streptomycin in cases and carriers of *S. flexneri* III, due to the lack of suitable control groups, certain observations should be mentioned. It was disappointing to find that the desired effect of the antibiotic in the dosages used in the first two courses was not attained since of the 60 individuals shown in

table 1, 41 or 68.3 percent were found to shed the organisms at some later time. It appeared, therefore, that the amounts of streptomycin employed early in the studies were wholly inadequate. As was described above, however, when the doses of streptomycin were greatly increased and extended over a 10-day period in 7 subjects an apparently complete elimination of the infecting organisms occurred. Subsequent to completion of this course of the drug, these individuals were cultured 31 times during a period of 47 days and so met the criteria established for adequate follow-up studies; none of these cultures was positive for *S. flexneri III*.

The question as to what constitutes an adequate number of negative rectal swab cultures for safe release to duty of individuals known to have been infected with *S. flexneri III* has been a serious problem for several years. Due to lack of sufficient knowledge and materials, and also to meet exigencies of duties, all too often no follow-up cultures have been made; in other more favorable circumstances from 1 to 5 negative cultures in a series have been required. Mention has already been made (2) of the suggestion that 12 consecutive negative cultures might be a fair requirement. With the objective in mind of attempting to find an answer to this question the data shown in table 1 were reviewed and it appeared that the best procedure was to examine the negative phases of those individuals who had more than one positive phase. If the maximum likely negative phase were known, individuals who undergo an excess of such a phase might be released with reasonable assurance that they would not later become positive. For the purpose of this analysis, a negative phase was defined as one or more negative cultures occurring between two positives. The apparent possible sources of error in this definition are: (a) A single negative appearing among a group of positives could easily be a "false negative"; (b) a single positive occurring among a group of negatives might possibly be a "false positive," but this is not likely; and, (c) on those days when no cultures are taken, observations of possible phase changes are lost. The amount of bias introduced by these factors is unknown but, from the general nature of the data, the last consideration appears to be the most important and its effect would be to give a somewhat longer negative phase than actually existed. It is possible, furthermore, that some of the coliform antibiotic principles described by Halbert (3) and Fredericq and Levine (4), or the "NC" phenomenon observed by Wharton and his coworkers (5), may have been operating during these studies with an inapparent increase in the numbers of negative cultures or length of negative phases. Since no data relating to these agencies were taken, it is impossible to estimate their importance in the present series. Taking these various points into consideration, a tabulation was made of the maximum numbers

of negative cultures in the negative phases of the 32 individuals showing more than 1 positive phase after the second course of streptomycin; from this arrangement, the percentages of individuals who remained positive after different numbers of negative cultures were calculated. The results are shown in table 3. For carriers and cases combined it is seen that more than one-half of the subjects had a maximum negative phase of more than 10 cultures, about 19 percent exceeded 20 cultures, and more than 30 cultures were necessary to include 95 percent of the group. All of the clinical cases fell into the groups below 21 cultures, but it is likely from the small number involved that this might be due to sampling variation. From the distribution of the total sample presented it is observed that if these individuals had been released on the basis of 10 consecutive negative cultures, one-half of them would have later shed the organisms. If 20 negatives had been the standard, about 20 percent would still have been harboring and excreting the *Shigellas* and, if 30 negatives had been required, approximately 5 percent would have been missed carriers and might have provided the necessary conditions to initiate another epidemic.

TABLE 3.—*Maximum negative cultures between positives*

Number of negative cultures	Total		Carriers		Cases	
	Number	Percent remaining	Number	Percent remaining	Number	Percent remaining
1-5.....	8	75	6	77	2	67
6-10.....	8	50	7	50	1	50
11-15.....	6	31	4	35	2	17
16-20.....	4	19	3	23	1	0
21-25.....	3	9	3	12		
26-30.....	1	6	1	8		
31-35.....	1	3	1	4		
36-40.....	1	0	1	0		
Total.....	32		26		6	
Mean.....	12.6		13.4		9.7	

Some additional characteristics of the population of 54 individuals are presented in table 4.

TABLE 4.—*Some further characteristics of adequately followed individuals*¹

Characteristics	Cases	Carriers	Total
Number.....	12	42	54
Average days followed ²	82.7	91.6	89.6
Average number of cultures.....	59.6	66.5	64.9
Average number positive phases ³	6.8	5.9	6.1
Average number negative phases ³	7.2	6.5	6.6

¹ On the basis of at least 20 cultures following second course of streptomycin therapy and an average of at least 1 culture every 2 days.

² 7 individuals given third course of streptomycin discharged from study at beginning of that treatment.

³ Of those with more than 1 positive phase.

DISCUSSION

In interpreting the observations herein described, and drawing any conclusions from them, the sources of bias previously mentioned should be considered, particularly the method of selecting the sample. The alternation of positive and negative phases that appeared suggests serious implications in the management of detected cases and carriers of *S. flexneri III*. The figures shown in table 1 lead one to suspect that once an infection is established, although there is marked individual variation, the periodic shedding of *S. flexneri III* by certain persons may continue indefinitely unless interrupted by some effective therapeutic agent. It appears probable that there are present aboard naval ships appreciable numbers of asymptomatic carriers of these organisms as a result of previous epidemics or sporadic cases who, unless they are detected and properly managed, present potent hazards to the health of their shipmates and to the effective operation of their ships. It is not presently known whether a similar situation exists in infections due to other *Shigella* types, but it must be considered as a possibility.

Due to the small number of subjects in the series presented and the absence of suitable controls, no definite commitment concerning the therapeutic efficacy of the drugs and antibiotic used is justified. As was previously known, and again confirmed in these studies, the organisms concerned were highly resistant to sulfonamides. The first two courses of streptomycin, each consisting of a total of 1.5 grams in equally divided doses in 3 days, failed to eliminate the organisms from the 41 individuals shown in table 1; whether they had any effect on the quantities of *Shigellas* later excreted or upon the number of negative cultures observed cannot be determined. Streptomycin in a total dosage of 30 grams, as described above, apparently was effective in completely eliminating the organisms from the 7 individuals mentioned. It is possible that a smaller amount of the antibiotic would have been equally effective, but this point could be determined only by suitably controlled experiments upon a significant number of selected subjects. In any event, the critical point in establishing bacteriologic cure depends upon adequate follow-up laboratory studies. It seems likely, furthermore, that if the larger doses of streptomycin had been employed initially an earlier bacteriologic cure might have been established in subjects so treated.

Unfortunately, no definite answer was found to the question of a suitable number of negative cultures to be required for the safe release of persons infected with *S. flexneri III*. It should be noted, in this connection, that the analysis was made upon the basis of the maximum series of negative cultures presented between positives. Because of this, and other factors mentioned, the results probably represent the

widest margins of safety for individuals of the type contained in the sample. Although the results do not make it possible to provide a satisfactory solution to the problem, the data do make it apparent that standards previously used for the release of persons infected with *S. flexneri III* have been wholly inadequate; a revision of such standards should be undertaken. Perhaps the management of such individuals should include the early administration of massive doses of streptomycin and a bacteriologic follow-up period to be determined upon the basis of these and desirable subsequent studies.

SUMMARY

Within a group of 60 individuals, comprising 14 clinical cases and 46 asymptomatic carriers, selected from a ship following an epidemic due to *S. flexneri III*, bacteriologic follow-up studies were conducted over periods varying up to a maximum of 202 days subsequent to the completion of two initial courses of streptomycin therapy. Rectal swab specimens from the subjects were cultured on an average of about 5 days per week per person and examined carefully for the causative organisms. An alternation of positive and negative cultural phases was observed in a sample of 54 individuals. The numbers of such positive phases ranged from 1 to 20 and the negative phases from 1 to 19. In a sample of 32 persons, the maximum number of negative cultures between positives ranged from 1 to 37, with a mean of 12.6. The organisms recovered were remarkably resistant to sulfonamides. Two initial courses of streptomycin, each consisting of a total of 1.5 grams equally divided over 3 days, had no demonstrable effect in eliminating the organisms from those so treated. When total dosages of streptomycin amounting to 30 grams were subsequently administered to 7 individuals, however, an apparent bacteriologic cure was established in each. The final course of the antibiotic was given in divided doses of 1 gram intramuscularly plus 2 grams by mouth daily for 10 days. Although it was hoped that some definite information would be obtained as to a suitable number of negative cultures that should be required for safe release of persons infected with *S. flexneri III*, the results presented do not provide a satisfactory answer to the question. The data shown make it quite apparent, however, that standards previously used are wholly inadequate and a revision of such standards should be undertaken.

REFERENCES

1. COOPER, M. L.: Personal communication.
2. VAN GELDER, D. W.; DAINES, W. P.; and FISCHER, G. L.: Shigella carriers with special reference to their therapy, including the use of streptomycin. *Am. J. Tr. Med.* 27: 225-231, March 1947.

3. HALBERT, S. P.: The antagonism of coliform organisms against shigellae. *J. Bact.* 54: 26, July 1947.
 4. FREDERICQ, P., and LEVINE, M.: Antibiotic relationships among the enteric group of bacteria. *J. Bact.* 54: 27, July 1947.
 5. WHARTON, J. D., et al.: To be published.
-

ACKNOWLEDGMENT.—The authors gratefully acknowledge the courteous and generous assistance of the Medical Statistics Division in conducting and interpreting statistical analyses of the data. The authors, however, accept full responsibility for the interpretations made and opinions expressed.



TOXIC EFFECTS OF CERTAIN BISMUTH COMPOUNDS

The Medical Director of the Food and Drug Administration, Dr. R. T. Stormont, has drawn attention to the "Discussion" in the article by Commander Boris Schuster (MC) U.S.N. on the "Therapy of Throat Infections With Bismuth *vs.* Penicillin," *U. S. NAVAL MEDICAL BULLETIN*, January-February 1948, in which Doctor Schuster stated that a new soluble bismuth suppository had been used with good effect. Doctor Stormont points out that some fatalities had occurred since 1943 when these suppositories were introduced and they had been withdrawn from the market. The toxic substance seemed to have been the diallylacetic acid part of the bismuth salt of this acid. While deaths reported seem to have been due to overdosage, the use of bismuth preparations with a greater margin of safety seems indicated.

THE TREATMENT OF FRACTURES OF EDENTULOUS MANDIBLES ¹

A Review

SIDNEY C. LIEDMAN
Commander (DC) U. S. N.

THERE has been very little written about the treatment of fractures of edentulous mandibles and it is the purpose of this paper to review the meager and scattered literature so that a somewhat organized discussion of such fractures may be propounded. It is not intended that this article be a detailed discussion of the complete treatment with all of its ramifications and complications, but that the complexities should be at least mentioned so that the dental surgeon will be cognizant of them. The intention is to discuss in a fairly detailed manner all of the well-recognized methods used to treat these fractures so that the person confronted with these problems will be better able to properly evaluate them and to discharge his responsibilities accordingly. It is hoped that more better-informed and experienced authors will be stimulated to write more freely and in more detail on this subject so that the profession and its patients will benefit thereby. The methods for treatment to be discussed have been well tried and approved. They are agreed upon by the majority of the authors listed in the bibliography.

As a general rule most fractures are the result of acts of violence to the patient. Sometimes the injuries are single and sometimes multiple. At times they are serious and endanger the life of the patient. The seriousness of the injury cannot always be evaluated by first impression. Therefore, it must always be realized that the patient is to be primarily considered and that the injury is important only in that it affects the welfare of the patient. It is of little use to surgically clean a wound or to obtain a perfect reduction and fixation of a fracture while the patient is in the process of expiring from shock. The treatment of most conditions which result from acts of violence does not always come within the realm of those who are called upon to treat them but they should be well enough acquainted with these conditions to properly care for them until the patient arrives at a hospital.

¹ U. S. Naval Hospital, Newport, R. I.

With this thought in mind, it is logical to begin with the discussion of the first-aid treatment of fractures because it is felt that this early treatment directly affects the type and results of later treatment.

A rapid physical examination can be made to determine whether or not the injuries are trivial or serious. Severe hemorrhage is easily discovered and should be controlled by firm pressure, tourniquet or ligature, which ever is indicated. Fractures should be immobilized before the patient is moved. It is not necessary to elicit crepitus or abnormal mobility as this invites the risk of displacing fragments and damaging blood vessels or nerves as well as increasing the probability of putting the patient in the condition of shock. Compound fractures are usually very easy to detect. Simple fractures may be located by abnormal position and localized tenderness over the bone. If the patient has been struck about the head and face it will be necessary to look for signs of cerebral damage. These signs are: escape of cerebrospinal fluid from the nose, "black eye" without a local bruising of the skin, escape of cerebrospinal fluid from the ear, bleeding from the ear which must be distinguished from hemorrhage from laceration of the meatus, and very deep stupor of the patient.

The treatment of the condition of shock should be instituted immediately. This can be done by stopping hemorrhage, immobilizing fractures, administering sedatives to control restlessness and to relieve pain, by keeping the patient warm and administering stimulants such as caffeine and sodium benzoate or adrenalin hypodermically. If possible, blood plasma should be administered at this time. Further treatment will vary, however, according to the nature of the injury. Where there is intracranial injury the type of sedative used is very important. The use of morphine, or other opiates, is contraindicated because they mask important signs and symptoms which will aid in the diagnosis of the type of injury sustained. Sodium luminal seems to be the drug most recommended for these cases. Whether or not the head should be lowered or elevated depends upon the presence of intracranial injury. In the treatment of shock the head is lowered, but such a position would only serve to increase the intracranial pressure in cases of cerebral injury.

In dealing with injuries about the jaws and neck one must be cognizant of special methods for controlling hemorrhage and bone fragments. The maintenance of an adequate airway is of the utmost importance. Although there are no very large blood vessels in the face as compared to other parts of the body, the tissues are very vascular, and in large lacerations a considerable amount of blood may be lost unless immediate treatment is given. The largest arteries of the face are the external maxillary, superficial temporal, inferior alveolar, and lingual. These arteries run with their veins and it

must be remembered that these veins do not have valves as do those of the lower parts of the body. The vessels of the neck are very large and are controlled in emergencies by exerting pressure upon them until more satisfactory measures such as clamping and ligation can be done. The facial vessels can usually be controlled by exerting pressure upon them, but when this method fails, they too must be clamped or ligated. In order to successfully use the pressure method, it can be seen that a thorough knowledge of the course of these vessels must be known so that pressure may be applied where it will do the most good and the least damage to other injured structures. The exertion of pressure upon these vessels can only be done if a means is at hand for maintaining a free airway for the patient. It may be necessary to pass an endotracheal tube or to perform an emergency tracheotomy. The throat should also be inspected for the presence of blood clots and foreign bodies such as teeth, bone fragments, and parts of broken dentures.

With bilateral fractures of the mandible the central fragment may be retruded due to the blow or the action of the suprahyoid group of muscles. In this instance the tongue will lose support and tend to drop back into the pharynx. Where there are teeth present it will be relatively easy to pass a piece of wire around the upper and lower teeth to hold the mandible in position. With similar fracture of an edentulous mandible it is not so simple to hold the central fragment in normal position. The tongue may require a stitch or safety pin to be passed through it which may be secured to the patient's clothing. When the tongue is badly lacerated a suture may be passed around the central fragment and secured to hold it forward. These are to be regarded only as temporary emergency measures. It is also recommended that the patient be transported in a face-down position to allow the tongue to come forward and permit drainage of slight hemorrhage and saliva.

The fractured jaw should be supported in some manner to prevent further injury. The support must be upward and never backward. A backward pressure will tend to cause respiratory embarrassment and to cause telescoping of the fragments. The Barton bandage has been the most recommended but the tendency is to apply it so as to cause backward pressure. Experience with the figure-of-eight bandage has shown it to be the most useful with head and neck injuries. It can be modified to apply to almost any part of the head and neck, and when used with crossties is very secure.

In short, first-aid treatment consists of properly preparing the patient for transportation without further endangering his life or causing further injury, and if possible, to prepare him properly for later definitive treatment.

After the patient has been transported to the hospital a more thorough examination may be made and the preliminaries to definitive treatment begun at once. The findings in this examination will determine the type of treatment the patient will receive as well as the procedures to be followed. With benign injuries their thorough treatment can be immediately started. The primary consideration in serious injuries is still to keep the patient alive and to improve his condition so that he will be ready for surgery as soon as possible. Here it is the prerogative and duty of the physician to do all that he possibly can. When there are injuries about the face and to the jaws it is believed that the assistance of the dental surgeon will be of inestimable value. He has a more detailed knowledge of the structures involved and their functions.

Supportive treatment such as blood transfusions, plasma and saline infusions, bed rest and sedation may be all that can possibly be done at first. If the patient is in satisfactory condition for further treatment the first-aid dressings may be removed and hemorrhage more permanently controlled. Large wounds and compound fractures should always be considered to be contaminated. Contaminated wounds are not to be considered infected wounds until the bacteria have had a chance to multiply and permeate the tissues. The use of sulfonamides and penicillin is important in that they tend to delay the development of infection. For this reason they should be used as early as possible in more serious injuries because it may be necessary to delay treatment until the condition of shock is adequately controlled.

The preference to be given in treatment of the various wounds and fractures will vary according to the types and locations of the injuries. Usually injuries which are amenable to primary closure should be given primary consideration. This is especially true of large wounds of the face and neck because the vital functions of respiration and nutrition are usually involved. Wounds should be cleaned thoroughly using soap and water. All devitalized tissue should be cleanly excised and all bone fragments removed that are completely detached or which have blood supply insufficient to keep them alive. The wound should be thoroughly irrigated, using quarts of sterile normal saline solution. It has been found that the action of sulfonamides and penicillin is relatively ineffective in the presence of dead tissue and purulent material, therefore a surgically clean wound must be produced before success can be expected with them. The use of bacteriostatics does not guarantee the control of infection, but will delay its development until the natural defenses can be mustered. Clean wounds can usually be sutured loosely to induce healing by first intention but the indications for this are relatively rare. Usually large wounds should be packed open until the progress of infection is arrested and eliminated. Pri-

mary suturing is usually indicated for wounds of the face, head, joints, nerves, and tendons. Prior to closure, chemotherapeutic agents may be sparingly placed in the wound where they go into solution in the tissue fluids and act on the bacteria for which they are specific. Sulfanilamide is useful because of its relatively high solubility although sulfathiazole and sulfadiazine have a wider range of action. It seems that a mixture of equal parts of sulfanilamide and sulfathiazole lightly dusted into the wound so that it is in contact with all exposed tissue is most nearly ideal. Penicillin may be used locally if a solution of 500 to 1,000 units per cubic centimeter is used and if it can be kept in contact with the tissues for at least 72 hours. It is extremely soluble and usually does not remain at the site of injury unless the dressings are removed too frequently.

Restlessness and apprehension may be controlled by such drugs as phenobarbital, triple bromides, barbitol and its derivatives, and acetylsalicylic acid. Pain may be controlled by hypnotics such as morphine, demerol, codeine, acetanilid, acetophenetidin, and acetylsalicylic acid. Morphine is apparently the most effective when it is not contraindicated.

The reduction and fixation of edentulous mandibles is usually not a simple procedure and requires more than simple intermaxillary wiring which is usually sufficient when there are teeth present. If there is no loss of bony structure, it is believed that the fracture should be reduced and fixed prior to the closure of facial lacerations if they are present. However, if bony structure is lost in sufficient quantity so as to cause a condition wherein later restoration will be impossible without plastic procedures, closure of the facial wounds becomes the primary consideration. The patient who has lost his facilities for speech and imbibition of food is a tremendous morale problem and greatly taxes the facilities of the nursing staff. Until he can be shown by action that he will have a good chance of again becoming somewhat normal in appearance he does not seem to care much about his chances of recovery. In other words he will be a poor operative risk because of his mental state.

Prior to stabilization of the fragments the patient should have a liquid or very soft diet which should be fortified to give more than ordinary caloric and nutritional requirements. The food should be made as appetizing as possible. Hot foods should be served hot and cold ones cold. They should be adequately seasoned, and if possible, garnished so that they will whet the patient's appetite. Because the patient is easily tired in taking an adequate meal all at one time he should be given smaller meals and should be fed between regular mealtimes. Special methods of feeding will need to be devised for those who have lost part of their faces. Some of these are the food cup with a rubber hose extension or a large syringe for those who

can swallow; a stomach tube and syringe for those who cannot. Frequently in battle casualties the patient is dehydrated and abundant fluids should be given. This can be done by mouth or by intravenous infusions of normal saline solution which may be fortified with glucose and hydrolized proteins.

Chemotherapy should be instituted as soon as possible. Bacteriostatics act by delaying the multiplication of bacteria until the natural barriers can be reinforced. Antibiotics are somewhat bactericidal in their action. The bacteriostatics most commonly used are sulfanilamide, sulfathiazole, and sulfadiazine. The antibiotic used most frequently is penicillin, although streptomycin, tyrothricin, and subtilin are coming to the fore. These agents can be used locally, enterically, intramuscularly, and in some cases intravenously. A word of warning should be given about the use of these agents. They are no panacea and should not be depended upon to correct all abnormal conditions. In some cases their easy use seems to be causing the neglect of well-established principles of medicine and dentistry. Each one is useful in combating only certain groups of organisms and none acts against all organisms. They are not effective where dead tissue and abscess cavities are present; the abuse of therapy by too frequent applications may lead to a considerable percentage of hypersensitivity. Organisms may become resistant to them when they are used in inadequate concentrations. Sulfonamides have the danger of serious complications such as blockage of the renal tubules, liver damage, destruction of blood cells, and anaphylactoid reactions. Penicillin has fewer detracting effects and it seems that the most serious is urticarial dermatitis. None of these chemotherapeutic agents are effective in combating infection unless they are used in adequate concentration. In chronic infections and contused wounds surgery should be considered of primary importance. When infections are localized and acute, chemotherapy and surgery are to be considered concurrently, while in acute spreading infections chemotherapy is of primary importance. Sulfonamides to be used in adequate amounts should be given in the amount of 1 grain per kilo of body weight per day. Blood and urine examinations should be made frequently and regularly for indications of damaging effects.

Usually sulfonamides are used by making the first dose a large one. Because they have been used in the treatment of nearly all diseases, a great many persons have had them prescribed at one time or another in varying amounts. For this reason it is reasonable to assume that quite a few persons have become hypersensitive to them. It seems rational, therefore, that we should make the initial dose a small one because a patient in serious condition may be in danger if an anaphylactoid reaction occurs. As these agents act only on certain organisms and not on all of them, a bacteriological examination

should be made to identify the bacteria at hand so that the most effective drug or combination of drugs may be used. It is true that some chemotherapeutic agents have a wider range than others, and may be used more indiscriminately than others, but this does not seem to be along the lines of rational therapy. Sulfadiazine is the most recommended for intra-oral and intravenous use.

Penicillin may be used locally in powder, liquid, or cream form in concentrations of 500 to 1,000 units per gram. However, provision must be made to keep it in the wound because of its relatively high solubility. It is usually given intramuscularly and 20,000 units every 3 hours is the recommended dose for mild infections. With severe infections 30,000 to 50,000 units should be given every 3 hours for the first day and then the rate reduced to 20,000 units every 3 hours. It is only effective when the concentration at the site of the infection is at least one-tenth unit per cubic centimeter. In the purified state it may be given subcutaneously quite painlessly. When it is given orally, it must be in doses of 100,000 units every 3 hours. Because it is relatively innocuous and has a wide range of action, being bactericidal against gram-positive and gram-negative cocci and most gram-positive bacilli, it is the chemotherapeutic agent of most general use. Streptomycin is effective against gram-negative bacilli and the *Tubercle bacillus*. In this light, it may be the supplement to the action of penicillin in combating most infections. However, not much is known about its real advantages and disadvantages. This statement is even more true of the newer antibiotics such as tyrothricin and subtilin.

Usually there is swelling and edema present about the site of the fracture. Sometimes it is possible to aid in the reduction of the swelling by the use of physiotherapy. Cold compresses are of value immediately after the injury to prevent swelling. Cold causes a constriction of the blood and lymph vessels and tight compresses aid in preventing blood and plasma from escaping into the tissue spaces. After swelling has occurred cold may be of value for a short time in non-infected cases; however, it is not recommended for infected ones. Heat causes a relaxation of the tissues and thereby aids in reestablishing more normal circulation to the part. It is true that the swelling may increase in volume, but the natural and chemotherapeutic defensive agents can be brought to the site in greater quantity. Therefore hot applications loosely applied are of the most value in treating swellings where there is infection present. Sometimes it is not possible to control harmful swellings by the usual methods and counter-incision may be necessary to cause relaxation of tissues suffering from lack of adequate circulation.

While all of the above-mentioned supportive and preventive treatments are being used prior to operating, and as soon as the patient is

able, a thorough physical examination of all injuries and physiological abnormalities should be made. The results of these examinations will determine the course and prognosis of the patient's condition. All tender places overlying bone should be gently manipulated and examined by x-ray for possibility of fracture of the bone. All bruises should be noted and a watch made for signs of deeper injury. Laboratory studies should be made to detect associated diseases such as anemias, hemorrhagic tendencies (hemophilia, jaundiced states, purpura), hypoparathyroidism, scurvy, diabetes, renal diseases, and cardiac diseases. Corrective measures should be made where any of these conditions are so that a greater degree of success may be expected. No complaint or symptoms should be ignored: I have in mind a patient who, in the heat of battle, was given emergency treatment for a fractured mandible and scalp laceration. He also complained of a backache and was found to have a fracture of vertebral body when time permitted examination by x-ray.

When other injuries take precedence over a fracture of any edentulous mandible, the mandible should be immobilized as soon as possible to prevent further damage. This can be done in a temporary way by using ordinary dental impression trays or by moulding some from sheet metal. These trays should follow the contour of the jaw as closely as possible and should not impinge upon the tissues. They can be filled with mouldable dental impression compound, or other dental impression materials which will remain firm at mouth temperature and which can easily be removed. Plaster of paris becomes too firm for easy removal and, because it is porous, becomes very unhygienic. These trays can be built up to come into contact with the upper jaw so that the lower jaw comes into a somewhat normal vertical relationship. Then plaster bandage can be moulded under the external surface of the mandible thus making a rigid support which can be incorporated in the various applicable head bandages.

With this brief discussion of the preparatory treatments considered it will be well to begin the more definitive treatment of the care of fractures of edentulous mandibles. As there are many types of fractures, it is logical to begin with the most simple and progress to the more complicated, adding the complexities of the treatment as we go.

The most simple type is the greenstick fracture of the body of the mandible with no soft tissue lacerations. This type has been practically unknown in the patient who was old enough to be edentulous but in later years many teeth have been extracted as a matter of expediency, and as a result complete dentures have been indicated as proper treatment. The services have found many who were in very poor dental condition and who would ordinarily put off undergoing a complete and properly indicated dental service. As a result there are more younger edentulous persons than at any time heretofore,

and also a higher incidence of this type of fracture. Usually the patient will be the possessor of a lower denture which can be articulated with the upper jaw and this denture can be used as a splint. If the patient has no denture an impression can be made and a denture or splint constructed. Most authors feel that the wearing of the splint or denture alone is sufficient if the patient is restricted to a liquid or very soft diet. It is felt that more support should be given to the mandible to fix the fragments more rigidly. This can be done by using the moulded plaster chin-cup and elastic bandage. A most rigid fixation can be obtained by attaching the denture or splint to the body of the mandible by using circumferential wires. The exact technique for this operation will be given later.

The next most complicated fracture is the simple or closed one with which there is no communication between the site of the fracture and the air. In this there is usually little or no displacement of the fragments. The reduction is comparatively simple and can be done with the aid of a local anesthetic or a drug producing narcosis. This is done to protect the nervous system and adds to the comfort of the patient to say nothing of adding to the ease of operating.

The operator should make an impression of the fractured jaw without attempting to effect a reduction at this time. The cast is made, and at the point of fracture a V-shaped cut is made in the cast on the underside so that the apex of the V is at the site of the fracture. The cast is fractured and the fragments set so that the alveolar ridge is in alignment and the whole set in soft plaster of paris, which when set will hold them fixed in that position. A splint is then constructed on the corrected model either of synthetic resin or metal. The fragments may then be manipulated and the splint inserted gently so that none of the oral tissues will be broken and thus compound the fracture. It seems that at this point the method of choice is to perform the following operation:

A small incision about 5 millimeters long is made at a distance of about 2 centimeters from both sides of the fracture in the shadow-line at the border of the jaw. These incisions should expose the bone. Then a 20-gage silver, stainless-steel or vitallium wire is passed on the lingual side of the body through the incision and up through the floor of the mouth. The other end of the wire is then passed up in the same manner on the buccal side of the body and the two ends twisted together so that the splint is firmly seated on the alveolar process. The same operation is carried out at the site of the other incision. The small incisions are left open to drain and are watched daily for any sign of infection.

Quite often these wires heal in and need never be touched until the time comes for the removal of the splint. If infection does develop,

a small gutta-percha drain may be placed so that it is in contact with the wires and when the time comes for removal of the wires no great deformity is caused. However, the small scars may be removed at any time by a simple plastic operation.

In placing these wires it is important to keep them sufficiently removed from the site of the fracture so that if infection does develop it will not reach the site of the fracture and delay the healing. The treatment of such a fracture is relatively simple if the patient is a possessor of a lower artificial denture and has teeth, either natural or artificial, in the maxilla. The lower denture is inserted and a plaster or metal chin-cup used with an elastic head bandage to keep the dentures in occlusion. If this method can be used there is practically no danger of complications from infection. The patient must be cautioned to exert great care to prevent any force against the fragments that will cause their displacement. The great advantage of using the method of circumferential wiring is that the jaw need not be immobilized completely and thus reduce the chances of limitation of jaw movements after the splint is removed.

A method which seems to be in disrepute consists of direct wiring of the bone fragments. It is true that this method is indicated in some instances but the usual result is the formation of necrotic bone around the wire and infection which causes loss of substance and delayed healing. When this method is indicated an incision should be made at the inferior border of the mandible not less than 5 centimeters long and in the shadow line. The soft tissue and the periosteum should be reflected on both the lingual and the buccal aspect of the body. Then four holes should be drilled through the bone, two above the mandibular canal and two below it so that there are two holes on each fragment. Care should be taken so that the soft tissues are not injured when the drill passes through the bone. This can be done by holding a thin-bladed instrument underneath the bone. One end of the wire is passed from lingual to buccal through the superior hole of one fragment and in the same manner through the inferior hole of the other fragment.

The same procedure is followed with the other wire and as a result the wires will be crossing on a diagonal line from one fragment to the other. The wires are tightened and the fragments manipulated to their correct position. When the wires are sufficiently tight to hold the fragments rigidly, the twisted ends are cut off and the ends turned down so that they lie against the bone. The periosteum is brought back into position and is retained by gut sutures. The overlying tissues are sutured with fine silk or horsehair material. Many times the wires will heal in and cause no irritation and may be left in permanently. The patient should be seen every day so that any infection that might develop can be cared for before any great destruction of

tissue takes place. If infection does develop, a stab incision should be made and a gutta-percha or thin rubber drain inserted at the inferior border of the mandible. If care is used in reflecting the tissues so that no opening is made into the oral cavity and the operation is done with an aseptic technique, there is no reason why infection should develop.

The next type of fracture to be discussed is the compound fracture, in which there is soft tissue destruction and wounds which communicate from the site of the fracture to the oral cavity or the surface of the face. These fractures should be treated as if they were infected from the start. The intraoral wounds should be thoroughly cleaned of all debris and held in place with fine silk sutures. Then the external wound should be thoroughly but gently cleaned of all foreign bodies and all unattached bone fragments and contused tissue removed. The wound should be irrigated with a great amount of sterile normal saline solution or mild antiseptic, such as Dakin's fluid, and the sides approximated. All ragged edges are to be removed and the skin loosened from the supporting structures so that it can be drawn together without a great amount of stretching. Prior to closure a mixture of equal parts of sulfathiazole and sulfanilamide should be lightly dusted into the wound. The deeper structures are to be sutured with gut after insertion of a gutta-percha or thin rubber drain. Then the skin is sutured with fine silk closely spaced with the drain extending from the lowest point of the wound.

The fracture may be reduced before or after the closing of the external wound but if the method of direct wiring is to be used the fixation should be done before closure. If there is no suppuration in the wound the drain may be removed after 3 or 4 days and the remainder of the wound sutured. If the wound may be closed at this early date a traction bow may be placed across the line of laceration so that tension will not be exerted and excessive scar formation result. The sutures may be removed in alternate positions after 3 days if the traction bow is used and all the sutures removed in 1 week, thus reducing the chance of producing disfiguration caused by the sutures. If the wound becomes infected the drain must be left until all suppuration is terminated and no thought given to any disfiguration, as scars may be removed at any time after the complete healing has taken place. Of course, the cause of the suppuration must be removed. Many times a small spicule of bone may become caught in the soft tissue or in the space between the fragments. Such spicules may be exfoliated or may have to be removed manually. This can be done by roentgenographic inspection or by gently probing to locate them. They may be picked out, or if too large to escape through the opening that exists, the opening will have to be enlarged to the size

that will permit their removal. These fragments are to be suspected of being present if the suppuration persists for a period of 3 weeks.

Next we come to the type of fracture in which there is a comminution of the bone. In this type we should not expect uniform results or response to treatment. If the fragments are not displaced from their normal position and there is not injury of the soft tissues or if they will heal at the site by first intention we do not have to deal with infection and can consequently expect to obtain good results. If the fragments are badly displaced and detached from the periosteum, the soft tissues badly lacerated, and the fracture compounded, we may expect copious suppuration and necrosis of the shattered fragments. These shattered fragments rarely will unite if restored to their former relationship. Whatever the fate of these fragments may be, we must observe conservatism to prevent traumatism to the periosteum so that its property of osteogenesis will be preserved. It is the consensus of opinion that these fragments be maintained so as to add to their support to the mandible, and that they should be removed only after they have sequestered. All wounds should be treated as mentioned above.

In the case of fractures where there is loss of substance such as in the type caused by gunshot we must modify our treatment. It must be remembered that the criterion for treating fractures is to place the fragments in their normal position. This eliminates the direct wiring method. The wounds are given their usual and accepted treatment of conservative and gentle debridement, then surgically prepared for closure, if possible. Frequently large wounds of the face can be closed as soon as the general condition of the patient permits surgical procedures. Such wounds have been closed by through and through suturing with fine steel wire and healing by first intention has occurred. These wounds were lightly dusted with microcrystalline sulfathiazole before closure. When these wounds are left open, saliva drains through them causing the edges to become inflamed and in time, badly macerated. This inflamed and macerated tissue will not heal properly and excision adds to the deformity. It seems, therefore, that an attempt should be made to close them as soon as possible to prevent such occurrences. They will need careful and frequent observation for signs of infection and the sutures should be removed if necessary. When such attempts are successful the results are striking and extremely satisfactory. When there is enough of the body remaining so that a splint can be wired to the fragments this should be done before closure of the lacerations. Sometimes the splint can be used in combination with an external pin fixation appliance to immobilize fragments when it is not possible to wire both fragments to the splint.

It is not believed that circumferential wiring of a splint to the mandible is sufficient to properly immobilize fragments. The method

should be supplemented by the use of the plaster chin-cup and head bandage. If the amount of bone lost is small and does not involve the entire thickness of the bone, union will usually occur. If the entire thickness is lost but not more than 1 centimeter in width, the posterior fragment may be brought forward so that it is in contact with the anterior and fixed in that position. As long as the realinement is not too abnormal function can be restored when the dentures are constructed. If the loss of bone is greater than 1 centimeter, fibrous union usually occurs, which in many instances becomes ossified and forms firm bony union. Where there is extreme loss of bone, a free or semi-pedicled bone graft will need to be inserted in the space. In these cases it is not always possible to apply successfully a splint of any type until the jaw has been sufficiently restored to support a splint.

Recently external pin fixation appliances have come to be used and were advocated as ideal for the fixation of fractured edentulous mandibles because intermaxillary wiring is impossible. It seems that they have not been successful in the hands of most operators. There are good reasons for the success or failure of any method of treatment. Statements have been made that the pins do not hold well, that infection of the bone and soft tissue have resulted, and that the fragments are not held firmly enough. It is believed that when these results occur it is because the operator has not properly used the appliances, and is not cognizant of their indications and contraindications. They should be used only when no other more innocuous method will suffice. The tissues through which the pins pass should be in normal condition and position. They should be used only when other methods will not control fragments and can be depended upon only until callus formation occurs. The field should be prepared as any other would be for surgical procedures and the pins should be inserted only by using the hand drill to prevent overheating of the bone. The appliance should be covered by plaster of paris so that it will be reinforced. The human element should be considered in that the patient should be the one who will not be likely to disturb the apparatus. It is true that soft tissue infection will occur even under the most ideal conditions but this should not preclude good healing of the fractures if they are adequately treated. These appliances do have a definite place in the treatment of edentulous mandibular fractures but they are not to be thought of as ideal under most conditions.

Some authors maintain that a satisfactory prosthetic appliance may be made that will restore the lost contour of the face satisfactorily. While this may be done it is not my personal belief that this restoration of contour will restore function to anywhere near suitable degree until restoration of the bone is done.

Up to this point we have considered unilateral fractures of the body of the mandible. When we are confronted with a bilateral fracture of the mandible of any of the mentioned types, the treatment is much the same except that it must be modified to compensate for the additional break in the bone. There is one instance where an additional appliance must be used. This will be in the case of a bilateral fracture of the body between the mental foramina and the angles. In this case there will usually be a displacement of the middle fragment posteriorly by the suprahyoid group of muscles. This action will allow the tongue to drop backwards into the throat so that breathing will be rendered difficult. In this instance the splint is wired on after correct reduction so that the ends of the wires are extending from the small incisions at the inferior border. The ends of these wires are attached to a rigid extension from a plaster head cap. The mandible is brought forward to its normal position and held there by attaching the wires to the rigid extension of the head cap. This may be one of the circumstances where immediate action must be taken even when the condition of the patient is critical and contraindicates the manipulation of the usual type of fracture.

The last type of fracture of the body of the mandible which we will discuss is the one in which there is a partial fracture, such as one where the lower border is chipped off. In this type there will usually be complete healing of the fracture if it is left alone. However, if it is felt necessary to administer some type of treatment the head bandage will suffice. The head bandage is not to be confused with the Barton bandage. The type to be used in any case where a bandage is indicated should support the mandible but should not be wrapped around the chin as it will cause retrusion of the mandible which may cause a telescoping of the fragments. It is best to use a plaster or metal chin-cup with the bandage.

In dealing with fractures of the angle of the mandible there will usually be displacement inward, outward, or forward due to the action of the muscles or the direction of the blow causing the fracture. There is not much that can be done in the treatment of this type of fracture that is very satisfactory. Probably the most rational treatment is the method of direct wiring of the fragments through external incision. As this type is rarely compounded into the mouth there is little chance of infection following the operation. If the tissues are opened due to the act of violence, they should be treated as if infected, and a drain of gutta-percha inserted before the wound is closed. Following the wiring or use of external pin fixation of the bone it is advisable to make impressions of the jaws and to construct splints, or use the patient's dentures if they are available and intact. These may be placed in their proper position in the mouth and the jaws held together by means of the head bandage.

If the fracture is in the area of the insertion of the masseter muscle there will be little displacement and the patient, if placed on a diet restricted to very soft foods and liquids, may be left alone and no treatment given. However, it is believed that the safest method for assured results is to use the head bandage with splints or artificial dentures to immobilize the jaws in their proper relationship. The operator is warned that in constructing these splints the proper vertical openings should be made. If this is not done and the intermaxillary space is too great, the ends of the fragments will not be in apposition. If the intermaxillary opening is too small there may be a telescoping of the fragments and a deformity as the final result.

When the condylar process is fractured and there is little displacement, the mandible should be immobilized by the splints or artificial dentures and the head bandage. If the action of the external pterygoid muscle has pulled the short fragment so far forward that the ends of the fragments are not in contact it may be necessary to operate through an incision just anterior to the ear and place the fragment in position by manual manipulation. They may stay in this position, due to the rough serrations interdigitating, or they may be wired together. Immobilization must be had so there will be no pulling apart or telescoping of the fragments. This is done as described before with the use of splints or artificial dentures and bandaging.

When the coronoid process is fractured there is little that can be done because the temporal muscle pulls it away from the ramus. If union does not occur it is of little consequence because the function will be compensated for by the masseter and internal pterygoid muscles. However if the fragment does not unite, it may be a source of irritation at a later time. In this instance, it should be simply removed by a surgeon who has a thorough knowledge of the anatomy of the region.

Most of the various types of fractures of the edentulous mandible and their treatment have been discussed in a fairly specific manner. One should bear in mind that the fractures may occur as they have been described in this article or there may be any combination of them. The treatment will have to be modified for each and a combination of the applicable methods used at the operator's discretion and good judgment. This can hardly be described in a discussion of this length. It is impossible to give any exact time to institute treatment because that is dependent on the condition of the patient. It is generally agreed that the time to institute treatment on any fracture is the earliest possible time that the condition of the patient will permit without endangering his life. The general opinion is that the earlier the treatment is begun the more satisfactory the result will be.

It is entirely appropriate to mention here some of the complications, although no attempt will be made to discuss them. By way of cau-

tion, the operator must be aware of these possibilities and so be on guard for their manifestations. Probably the most common complication following a compound fracture is osteomyelitis. Delayed union or failure of union is another and may be caused by debilitating diseases such as anemia, tuberculosis, syphilis, carcinoma, sarcoma, dietary deficiencies, diabetes, and osteomyelitis. Tissue caught in the line of fracture may also delay union or cause malunion. Tetanus is always to be suspected of being present and suitable measures should be taken to prevent this disease. There may be fat embolism from the bone marrow which may result in the death of the patient. This will usually occur early in the course of treatment if it is to occur at all. There may be an embolism from a blood clot which usually occurs in the third week after the injury if at all. Gangrene may result from the loss of collateral circulation from a tight bandage or from pressure on an artery by a hematoma or tumor. Septicemia may result from the infection of the tissues. There may be suffocation from retrusion of the mandible or from deep infection of the neck itself, which is a serious complication. Ankylosis may result from the prolonged immobilization of the jaw or injury to the joint. It is hoped that this mere mention of these possible complications will stimulate the reader to acquaint himself with their treatment so that he will be able to cope with each situation if it becomes necessary.

A few words must be said about the choice of anesthetic to be used in oral operations. The choice should never be an arbitrary one but in the choice the following factors should be held as paramount: safety, efficiency, expedience, and attitude of the patient toward the anesthetic. We must be guided by the general health of the patient; the nature, location, and the duration of the operation. The convenience and the patient's desires are the last to be considered. The advantages and disadvantages of each anesthetic agent due to its own inherent physiological properties are known generally to all but sometimes the operator may be at a loss to decide which type to use: local or general anesthetic. It seems that the advantage of local anesthesia outweighs its disadvantages to such a degree that it should be the usual method chosen. The advantage of local over general anesthesia for use in the oral cavity is well known by all those who employ it. Probably the only manner in which an inhalation anesthetic may be given successfully is by means of the endotracheal tube so that the proper control of the anesthetic agent may be maintained. As most operations in the oral cavity involve the bone, we will find that it will be impossible to maintain a bloodless field except when a hemostatic is used. Such an agent is contained in most all prepared local anesthetic solutions. We will have the cooperation of the patient with local anesthesia. Excesses of the drug are not necessary for the

time that the anesthetic is needed and we do not have to contend with nausea, vomiting, excessive secretions of saliva, or respiratory disturbances found accompanying general anesthesia. The recovery of the patient is more rapid and less troublesome, and damage to the vital organs is negligible. It seems that the only contraindication to use of local anesthesia is in cases where there is excessive damage to the tissues accompanied by extreme swelling which renders it difficult to make a safe injection. In these cases the method of choice seems to be the use of the general anesthetic agents which are used by intravenous or rectal administration.

The patient should have some sort of a sedative before any operating is done and before any anesthetic is used. This reduces the apprehension and tendency towards nervous exhaustion as well as increasing the effect of the anesthetic and reducing the amount necessary to obtund the pain. The barbitol derivatives have been used successfully; however, it seems that the use of the "old stand-bys" such as morphine or codeine cannot be effectively supplanted.

Patients with fractured jaws must necessarily be given a change of diet. If this is done as gradually as possible the digestive mechanism will not be easily upset. Most of the usual foods may be used at first, provided they are put through a sieve or thoroughly ground so that they have a smooth consistency. The diet should have a high caloric count and high vitamin, high mineral content. It must appeal to the appetite so that the patient will want to eat as much as possible. Because of the difficulty in inhibiting adequate amounts of foods, the patient's activity must be reduced as much as possible. Some of the recommended foods are as follows: fortified beverages (malted milk), infant cereals with milk or cream, butter should be used wherever possible, mashed eggs, or eggnogs, many smooth desserts supply good amounts of carbohydrates, fruit juices should be used in large quantities, meat broths and puréed vegetables, creamed soups, and strained vegetables should be used for their mineral content. After the appliance is removed the diet should remain soft until solid union is established and then should be gradually returned to normal.

SUMMARY AND CONCLUSION

When first examining a patient brought in for treatment, try to estimate the general condition of the patient before giving him any treatment. If his general condition is not favorable, let him rest until his condition is such that treatment of the fracture will not seriously affect the prognosis of the case. All soft tissue wounds should be gently but thoroughly cleaned and put in a condition so that nature will be aided as much as possible in healing. In general there are four methods of treating fractures of edentulous mandibles: circumferential wiring of

a splint or denture to the body, direct wiring of the fragments to each other, the use of the elastic head bandage with a plaster or metal chin-cup and external pin fixation. Any combination of these methods may be necessary depending on the nature of the fracture. Postoperative complications are usually of an infectious nature, debilitating diseases, emboli, and gangrene are also listed as affecting the process of healing. In general it seems best to use local anesthesia where an anesthetic agent is indicated. Care should be used in the administration of preoperative sedatives. The diet should not be too radically changed immediately after the fracture or immediately after the treatment is complete.

Teamwork between the physician, the dental surgeon, and the nursing staff is essential in all the phases of treatment in order to bring the case to a successful culmination.

BIBLIOGRAPHY

1. ADDISON, P. I.: Treatment of non-union and loss of substance in fractures of edentulous mandibles. *J. Am. Dent. A.* **25**: 1081-1084, July 1938.
2. ACKMAN, D., and SMITH, F.: Role of chemotherapy in wounds and surgical infections; clinical and bacteriologic studies. *Ann. Surg.* **123**: 70-95, Jan. 1946.
3. KERN, R. A. and ASTON, M. J.: Wartime log of United States naval hospital ship to 30 June 1943; part III. *U. S. Nav. M. Bull.* **47**: 94-108, Jan.-Feb. 1947.
4. BEDER, O. E.: Appliances to correct resected or missing portions of edentulous mandible showing extreme loss of bone; report of case. *Am. J. Orthodontics (Oral Surg. Sect.)* **32**: 59-66, Jan. 1946.
5. BERGER, A.: Principles and technique of oral surgery. *Dental Items of Interest* (Publishing Co., Brooklyn, N. Y.) 1923. pp. 46 and 328.
6. BLAIR, V. P.; BROWN, J. B.; and BYARS, L. T.: Early local care of face injuries. *Internat. J. Orthodontia* **23**: 515-533, May 1937; also *Surg., Gynec. & Obst.* **64**: 358-371, Feb. (No. 2A) 1937.
7. BLAIR, V. P.: *Surgery and Diseases of the Mouth and Jaw*. 3d edition. C. V. Mosby Company, St. Louis, Mo. pp. 46, 65, and 93.
8. BLOOM, H. J.: Supportive therapy in oral surgery. *Am. J. Orthodontics (Oral Surg. Sect.)* **32**: 67-75, Feb. 1946.
9. BROWN, J. B.: Fractures of bones of face. *Am. J. Orthodontics* **25**: 432-446, May 1939; also *Surg., Gynec. & Obst.* **68**: 564-573, Feb. (No. 2A) 1939.
10. BROWN, J. B., and PETERSON, L. W.: Ankylosis and trismus resulting from war wounds involving coronoid region of mandible; report of 3 cases. *Am. J. Oral Surg.* **4**: 258-266, July 1946.
11. CLARK, O. E.: Appliances to correct resected or missing portions of edentulous mandible. *Am. J. Orthodontics* **4**: 321-324, Oct. 1946.
12. CLEVELAND, M., and GROVE, J. A.: Delayed primary closure of wounds with compound fractures. *J. Bone & Joint Surg.* **27**: 452-456, July 1945.
13. CONNOLLY, F. A.: Symposium on head injuries; diagnosis and management for first 48 hours. *Nebraska M. J.* **31**: 268-271, July 1946.
14. CONZETT, D. C.: Present-day concepts of fracture management. *J. Iowa M. Soc.* **36**: 282-285, July 1946.
15. DENEN, H. E.: Prosthetic restoration following shrapnel injury of mandible. *U. S. Nav. M. Bull.* **46**: 1732-1736, Nov. 1946.

16. DOHERTY, J. A.: Fractures of jaws. *Am. J. Orthodontics & Oral Surg.* **24**: 165-170, Feb. 1938.
17. DWYER, F. J., and MURRY, D. H.: Fractures treated by skeletal traction or dual pin fixation; report of 252 cases. *Northwest Med.* **45**: 173-177, March 1946.
18. EVELETH, M. S.: Use of sulfonamides in compound fractures. *J. Bone & Joint Surg.* **27**: 486-490, July 1945.
19. FENNELLY, W. A.: Avertin in reduction of fractured facial bones. *J. Am. Dent. A.* **24**: 1089-1104, July 1937.
20. FERGUSON, L. K.: Surgery of the Ambulatory Patient. J. B. Lippincott Co., Philadelphia, Pa., 1942. pp. 18-58; 80-104.
21. FOSTER, R. B.: Oral surgery in amphibious warfare. *J. Am. Dent. A.* **33**: 293-304, Mar. 1, 1946.
22. FREY, W. K.; SHEPHERD, P. R.; McLEOD, A. C.; and PARFITT, G. J.: The Dental Treatment of Maxillo-Facial Injuries. J. B. Lippincott Co., Philadelphia, Pa., 1943.
23. GINGRASS, R. P.: Early management of facial fractures. *J. Am. Dent. A.* **25**: 693-699, May 1938.
24. GRIMSON, K. S.: Healing of fractures of the zygoma. *J. Am. Dent. A.* **24**: 693, 1938.
25. HOFFMAN, W. S.: Penicillin, its use and possible abuses. *J. Am. Dent. A.* **34**: 89-99, Jan. 15, 1947.
26. IVY, R. H., and CURTIS, L.: Fractures of the Jaws. Lea & Febiger, Philadelphia, Pa., 1931. p. 44.
27. JONES, W. I.: Fractures of edentulous mandible. *J. Am. Dent. A.* **24**: 1361, 1939.
28. KEY, J. A., and CONWELL, H. E.: Management of Fractures, Dislocations, and Sprains. 3d edition. The C. V. Mosby Co., St. Louis, Mo., 1942. pp. 39-40; 45-51; 119-136; 151-164; and 257-258; pp. 108 and 288.
29. LAZANSKY, J. P., and WUEHRMANN, A. H.: Failure of union in mandibular fracture and its successful nonsurgical treatment. *Am. J. Orthodontics (Oral Surg. Sect.)* **32**: 182-183, Mar. 1946.
30. LOGAN, W. H. G.: Lectures.
31. National Research Council. Committee on Surgery: Manual of Standard Practice of Plastic and Maxillofacial Surgery. W. B. Saunders Co., Philadelphia, Pa., 1942. pp. 3-48; 55-83; 262-286; and 287-400.
32. MEAD, S. V.: Metal in bone and soft tissue. *Am. J. Orthodontics* **25**: 377, 1939.
33. MEAD, S. V.: Diseases of the Mouth. 4th edition. C. V. Mosby Co., St. Louis, Mo., 1933. p. 697.
34. PADGETT, E. C.: Surgical Diseases of Mouth and Jaws. W. B. Saunders Co., Philadelphia, Pa., 1938. p. 119.
35. RICHARDS, R. L. (Los Angeles): Methods of immobilization of fractured mandible. *Am. J. Orthodontics (Oral Surg. Sect.)* **24**: 973-979, Oct. 1938.
36. THOMA, K. H.: Functional disturbances following fracture of mandibular condyle, and their treatment. *Am. J. Orthodontics (Oral Surg. Sect.)* **31**: 575-596, Oct. 1945.
37. VANDER VELDE, K. M.: Surgical technique for facial lacerations. *U. S. Nav. M. Bull.* **46**: 1451-1452, Sept. 1946.
38. WEISENGREEN, H. H.: Diet of patient with fractured jaw. *J. Am. Dent. A.* **24**: 1855-1857, Nov. 1937.
39. WISER, H. J., and McAFEE, M. F.: Symposium on military medicine aboard U. S. S. *Samaritan*; Injuries of face and neck in war casualties. *U. S. Nav. M. Bull.* **46**: 57-66, Jan. 1946.

CLINICAL CASES FOR DIAGNOSIS

MARION B. SULZBERGER

Captain (MC) U. S. N. R.

and

MAX JESSNER, M. D.¹

Case 1.—R. L., female, white, aged 37, complains of a skin eruption which developed during the past 4 weeks. On the chin of the patient 4 lesions are present. They are of different size and aspect. One is a pea-sized reddish papule with a whitish center. Two others are smaller papules, whitish, shiny and show a distinct umbilication. The fourth and smallest is also a whitish papule but is not umbilicated. All of them are hard to palpation.

One of the papules was excised. The histological picture shows a papular elevation of the normal border of the epidermis. The small tumor proliferating into the cutis consists of prickle cells, is sharply circumscribed and somewhat separated from the surrounding cutis by a space partly filled with serum. The surface of the tumor shows a cavity partly filled with horny lamellae and masses of round bodies. The epithelial mass of which the tumor consists is lobulated and the papillae are compressed. The border of these lobules towards the cutis is composed of normal-appearing prickle cells surrounded by a layer of basal cells, but towards the centers of the lobules darker stained areas are to be seen, showing a high content of granular material and round bodies which communicate with the above-mentioned masses of round bodies, filling the surface cavity.

Therapy consisted of curettage of every lesion. This, as usual, resulted in cure.

Case 2.—R. R., female, white, aged 37, complains of an itching eruption which began 8 weeks previously. The eruption is localized on the wrists, forearms, in the antecubital spaces, on the ankles, flexor aspects of the thighs and the popliteal regions. It consists of discrete and confluent, shiny, brownish-red papules. The isolated papules are of pin-head size or somewhat larger and of irregular shape. Some show a central umbilication. Some are arranged in lines. Apart from these shiny lesions there are others on the ankles which are vesicular and some even bullous. These seem to arise from papules. The buccal mucosa is not affected.

One of the shiny small papules on the wrist was excised. The histological picture shows the following: The papule is localized around a sweat gland duct, a cross-section of which is to be seen in the hyperkeratotic horny layer covering the lesion. There is no parakeratosis present. The granular layer is greatly increased and the whole epidermis shows a mild acanthosis. The rete pegs are small and irregular and separate papillae which have an "en coupole" appearance. In the upper part of the cutis there is edema, the vessels are enlarged and an inflammatory infiltrate is present; the infiltrate is rather sharply demarcated towards the deeper part of the cutis in a convex shape and consists almost entirely of lymphocytes.

The correct diagnoses of these cases are given on page 446.

¹ From the New York Skin and Cancer Unit, Department of Dermatology and Syphilology of the New York Post Graduate Medical School and Hospital (Dr. Marion B. Sulzberger, Director).

CLINICAL CASE FOR DIAGNOSIS
WHAT IS IT?



Case 1



Case 2

From these pictures and case histories one can test his dermatological knowledge. Write down your diagnosis for each case at the bottom of the page and then turn to the last page of the editorial section for the diagnosis of the actual case.

NAVAL MEDICAL HISTORY



One of the most frequent suggestions made in answers to the recent questionnaire sent out to readers of the UNITED STATES NAVAL MEDICAL BULLETIN was for a page devoted to naval medical history. With this number a section on this subject is initiated with a short historical comparison of the Bureau of Medicine and Surgery and the Medical Department 50 years ago and now.



1898-1948

1948 is the Fiftieth Anniversary of the Spanish-American War. It is interesting to make some comparisons of the state of the Medical Department then and now.

In 1898 there were but four officers on duty in the Bureau of Medicine and Surgery: the Surgeon General, the Assistant Chief of the Bureau, and the "Attending Surgeon." The latter constituted the principal part of the Naval Dispensary. These three comprised the usual officer complement. Because of the exigencies produced by the Spanish-American War, a fourth officer was added. This was Passed Assistant Surgeon E. R. Stitt, afterward Surgeon General of the Navy. The Bureau was then considered to be absolutely bursting with officers. The number of officers 50 years later is 130, including 53 medical officers; the remainder belonging to the other Corps of the Medical Department established in the last half century. There were in 1898 a total of 161 medical officers on the active list and 25 pharmacists of the newly formed Hospital Corps.

The civilian personnel of the Bureau of Medicine and Surgery in 1898 consisted of exactly eight persons: five clerks, two laborers and a janitor. The annual appropriation for the pay of these civil employees was \$8,740. In 1948, there are 420 civilian employees and the

appropriation is \$1,078,000. The entire appropriation for the operation of the Medical Department for the fiscal year of 1898 was \$145,340. This is in marked contrast to the present budget for the Medical Department of \$37,500,000.

The number of sick in naval hospitals during 1898 averaged 340. Of these, about 10 were at the 2 overseas hospitals at Sitka, Alaska, and Yokohama, Japan. The others were in the 9 hospitals within the continental limits. There were 99 insane cases retained in the Government hospital for the insane. About 31,000 men were examined for enlistment during the year and over 21,000 accepted. The average strength of the Navy and Marine Corps during the period of hostilities was 26,102. The average strength in 1896 was 14,196. The very considerable increase in 1898 was, of course, the consequence of the war.

There is a striking historical interest in the year 1898 as it represented a real turning point in our history. It was the year in which we became a world power and many of the events of the last 50 years are the natural consequences of the new and greater part our nation has been called upon to play in world affairs. Our interests in the Pacific and in Asia that resulted from the Spanish-American War led step by step to World War II and in a sense the bombs of Pearl Harbor were the echoes of Dewey's guns at Manila Bay.

The Spanish-American War had far-reaching effects on the Medical Department. With the expansion of the Navy, increase in the size of the Medical Department followed. The establishment of the Hospital Corps, Nurse Corps, Dental Corps, and finally the Medical Service Corps all stemmed from this expansion. Medical personnel became familiar with the overseas bases, with tropics and a general impetus was given to the study of tropical medicine, a field in which many naval medical offices won distinction.

The standards for entrance into the Medical Corps were severe 50 years ago. Of 65 candidates appearing before the examining boards, 17 were rejected physically, 19 were rejected professionally, 12 withdrew, and only 17 survived the ordeal. This is acceptance of about 25 percent. As those who withdrew did so usually because they felt they could not pass the professional examination, about one-half of the candidates were not taken because of inability to meet the professional standards.



THE FIRST MARITIME HOSPITAL AND THE SECOND OLDEST HOSPITAL IN THE NEW WORLD ¹ (IN SANTOS, BRAZIL)

DR. ODAIR PACHECO PEDROSO

Translated by Captain Carroll P. Hungate (MC) U. S. N. R.

"House of God for Men, Open Door to the Sea," Braz Cubas. In 1543, in a muddy land, full of swamps and quagmires, inhabited sparsely by Indians, the Enguaguassu, near a lagoon interwoven with marshes and small islands, Braz Cubas, moved by a compassionate human feeling, founded on the hill of Saint Catherine the Home of Mercy which he called "All Saints Hospital," in the shade of which the village flourished. It became known as "Santos" (Saints).

The sufferings which assailed sailors arriving sick at the port, or who became sick after contact with the barren soil, caused the port Captain to think about the erection of a refuge, administered by a religious order, to shelter them.

He related his intentions to the fathers of the village and obtained their entire approval. Thus he established on the soil of America the first hospital and the first religious fraternity of mercy. It was confirmed by D. Joao III of Portugal, in Almerin, on the 2d of April 1554, "granting them all privileges given by his Father to charity institutions of the Kingdom."

Braz Cubas, in a gesture much like the men who spread "the Faith and the Empire"—in declaring the inauguration of the "House of God for Men—Open Door to the Sea," established in the merciful fraternity, the aims of this house of charity—all, absolutely everyone, without distinction of nationality, color, creed, or class who required balm for their suffering, will be received with joy in this place of healing.

With such high, merciful purpose the Santa Casa was founded.

In a continued progress for the good, amplifying all the time the benevolent work, during these four centuries of complete service, faithfully fulfilled, it has accomplished its high aim.

After Braz Cubas—the immortal founder of Santos—there came into the history of Santa Casa the impressionable person of a doctor who was their guardian angel.

¹Based on a historical monograph and research by Dr. Ismael de Sousa. The hospital is the second oldest in the Western Hemisphere and is the first established for seafaring men. It thus can be regarded as the oldest naval hospital in the Americas. The oldest hospital in the New World is believed to be the Hospital of the Immaculate Conception and Jesus the Nazarene in Mexico City, founded in 1524. There is some evidence that a hospital was established in Santo Domingo City as early as 1512.

At the end of 1831 there appeared in the village of Santos, coming from the Court, Dr. Claudio Luiz da Costa, native of Desterro, the then "Capitania of Santa Catharina," legitimate son of the Sargent-Major Joao Luiz Ignacio da Costa and Dona Joaquina de Bitencourt who, when 16 years old, finished the preliminary studies and entered the Medical-Surgical School whose course was of 3 years; graduating with honors in April 17, 1817. After graduation he moved to Bahia, where he practiced in Sao Francisco. Exalted patriot, lover of liberty, he took part in the Independence wars as Major-Surgeon of the Battalion, refusing to receive pay to which he had a right; and, when after the restoration of Bahia, he was ordered to dispose of the pay, he ceded it to public charity. The wars for political emancipation in which he took part aggravated his economic situation in such a way that, ruined and without the agricultural property of Sao Francisco, also without a clinic, he was obliged, in 1823, to move to Sao Salvador where with the same rank he was removed in 1826 to the Imperial Division of the Court Police, remaining there until 1831, when he was nominated a member of the Commission in charge of organizing a reform project of the Army Health Corps, which project was not completed. Still in Rio de Janeiro, by request of Debret, professor of historical painting in the Imperial Art Academy, he taught osteology with great success and free of charge, to the pupils of this speciality.

Of Braz Cubas whom he revered, he wrote: "I have today the glory to exalt you in this Hospital of Santa Casa da Misericordia in the village of Santos; to pronounce your name with respect as its founder and first protector. Your memory will always be indelible in the annals of this Brotherhood which we must consider as a sacred monument of gratitude to posterity."

"Claudio Luiz da Costa is an indefatigable worker. As Purveyor he increases the Hospital's income; he reforms the buildings of its patrimony; he promotes revenue; he studies legislation of the Santa Casa; he reforms the Agreement; he accepts contributions of the Philanthropic Society; he increases the comfort of the sick; he shelters the poor; he looks after abandoned children; he takes care of the insane.

"On September 4, 1836, after great effort and many hardships, and amid the admiration and respect of the people, he inaugurated the new building of Santa Casa."

The fundamental principles of this Brotherhood that founded this second oldest hospital in the Americas and the first for sailors were 14, 7 spiritual and 7 corporal; the 7 spiritual are as follows:

- First—to teach the simple-minded;
- Second—to give good advice when asked;
- Third—to punish those in error;
- Fourth—to comfort the afflicted;
- Fifth—to pardon those who brought us up;

Sixth—to suffer injuries with patience;
Seventh—to pray for the living and the dead.

The seven corporal principles are:

First—to ransom the captives and visit the prisoners;

Second—to treat the sick;

Third—to dress the naked;

Fourth—to feed the hungry;

Fifth—to state the thirsty;

Sixth—to lodge the travelers;

Seventh—to bury the dead.

These works of Mercy shall be done whenever possible.

The present modern hospital, the direct successor of this old hospital “open toward the sea” and the first hospital for sailors in the New World, is now completed, having been rebuilt as a modern hospital to serve the needs of Santos and Sao Paulo.



THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



THE CAUSE OF LIMITATIONS OF KNEE MOTION AFTER FRACTURE OF THE SHAFT OF THE FEMUR

Limitation of the movement of the knee joint, amounting at times to actual ankylosis, is one of the difficulties in the management of fractures of the femur. It is of less importance in fractures of the surgical or anatomical neck but when the shaft is involved stiffness of the knee invariably occurs and is one of the most troublesome sequelae.

At the Hunterian Lecture, delivered before the Royal College of Surgeons in 1946, Charnley discusses this subject and proposes an interesting theory of the cause of knee stiffness after fracture of the femoral shaft, supporting it with a number of interesting observations. He believes that adhesions between the shaft and the quadriceps is the main difficulty rather than within the joint itself. He points out that long continued immobilization of the knee in fracture of the tibia and fibula are unattended by serious knee stiffness. During manipulation of the joint, fractures of the patella have occurred indicating adhesions proximal to it. Finally, plastic operations on the quadriceps have demonstrated adhesions at the fracture site extending into the vastus intermedius. Early beginning of passive and active motion does not lessen the permanent limitation of motion.

Adhesions within the joint have been demonstrated in cases where an arthrotomy has been done. It would appear that more than one factor is involved but this distinguished English surgeon does show rather conclusively that ossifying adhesions between the fracture site and the quadriceps are a major cause of the knee stiffness and limitation of motion following fracture of the shaft of the femur.



IMMUNIZATION AGAINST POLIOMYELITIS

Infantile paralysis, considered from the standpoint of number of patients involved, is one of the less serious public health problems. Its long course, its frequent permanent crippling effects, and its greater incidence among children make it a matter, however, of major importance.

It has long been suspected that it is a disease that is universal among the population, that there is general immunization through subclinical infection, and that clinical cases represent overwhelming infection, or breakdown of immunity by fatigue or other factors. A number of workers before the war studied the possibilities of immunization by injection of an attenuated or killed virus. Results were unfavorable with a dead virus. With the attenuated virus, immunization was obtained in some degree, and was used in man, more than 25,000 doses being distributed. A number of children developed paralysis while taking the vaccine, however, and the whole program was considered too dangerous to continue.

At the time this work was done, the virus had not been isolated in a relatively pure state and in most instances was made from the ground cords from the monkey somewhat as rabies virus is obtained from rabbit cords. The presence of foreign proteins was one objection, and also the difficulty of reaching the virus with attenuating agents such as formaldehyde or sodium ricinoleate. Now a purer virus can be obtained, and workers at Stanford University have prepared a vaccine and used it successfully with immunization of animals. It is too early to make any predictions as to its safe application to man but it represents one more step in the solution of this problem.



THE OATH OF HIPPOCRATES

Sometimes it has not been realized by the modern medical man that the foundation of all medical ethics goes back almost 2,400 years to Hippocrates. It is true that there are one or two features of the Hippocratic oath which may seem a little out of date but a careful examination of it will show that this is not the case and that the principles inculcated by it are unchanging. For the convenience of the medical man who would like to look at these tenets again it is reproduced here.

"I swear by Apollo, the physician, and Æsculapius, and Hygeia, and Panacea, and all the gods and all the goddesses—and I make them my judges—that this mine oath and this my written engagement I will fulfill as far as power and discernment shall be mine.

"Him who taught me this art I will esteem even as I do my parents; he shall partake of my livelihood, and, if in want, shall share my goods. I will regard his issue as my brothers and will teach them this art without fee or written engagement if they shall wish to learn it.

"I will give instruction by precept, by discourse, and in all other ways to my own sons, to those of him who taught me, to disciples bound by written engagements and sworn according to medical law, and to no other person. So far as power and discernment shall be mine, I will carry out regimen for the sick and will keep them from harm and wrong. To none will I give a deadly drug, even if solicited nor offer counsel to such an end; likewise to no women will I give a destructive suppository; but guiltless and hallowed will I keep my life and mine art. I will cut no one whatever for the stone, but will give way to those who work at this practice.

"Into whatsoever houses I shall enter I shall go for the benefit of the sick, holding aloof from all voluntary wrong and corruption. Whatsoever in my practice or not in my practice I shall see or hear amid the lives of men which ought not be noised abroad—as to this I will keep silence, holding such things unfitting to be spoken.

"And now if I shall fulfill this oath and break it not, may the fruits of life and art be mine, may I be honored of all men for all time; the opposite if I shall transgress or be forsworn."



POSTURE

The habitual position assumed by an animal is the most comfortable for it and probably the most economical in energy production. In other words, it is the most healthful. The animal, also, is uninhibited by social customs or educational systems. A tiger is not told to square his shoulders and tuck in his chin in order to breathe more deeply.

There is a definite distinction between what may be called social posture and healthful posture. The two are not the same thing, yet in much of the thinking and writing on posture, even by members of the medical profession, the two are not clearly separated. Military posture while desirable from the standpoint of appearance of the

uniformed individual and of military formations is not necessarily the best from the standpoint of physiological efficiency.

There is a field for research into this question. What is the most favorable position for the body at rest and in motion? What is the efficiency of the cardiovascular system in various positions? The nervous system? The respiratory system? The digestive system? What are the positions naturally assumed in work, at rest, and in sleep in relation to the comfort and well-being of the human animal without relation to appearance or to any preconceived ideas set by the social mores for the individual and carried by him as inherent prejudices? A study to find the answers to these and other questions that might arise during the investigation would be of value in lessening many physiological stresses and actually advance individual health.



NUMBER OF BIRTHS IN UNITED STATES IN 1947

Those who are predicting a nation of old people; the lessening of the need for kindergartens and elementary schools; and an increase in the number of specialists in geriatrics; will be compelled to revise their views if the birth rate in the United States for 1947 is repeated very many times.

According to the figures of the United States Public Health Service, registered live births for that year were 3,720,000. With estimated births of the nonregistered areas, the number for 1947 was 3,910,000. This exceeds any previous year's birth rate of 25.9 per 1,000 if armed forces overseas are included.

There has also been a distinct decline in the number of stillbirths. The number is about 15,000 less than 15 years ago and taking into account the change in total population, stillbirths were about 17 percent less than in 1934.

With the highest birth rate, the mortality rate for infants fell to a new low. Thus the population in younger-age groups is still further increased.



INDIVIDUALISM IN DIET

"One man's meat is another man's poison" is one of those old proverbs full of homely folk wisdom, and too often disregarded in this age of regimentation. With our modern knowledge of intestinal allergies, we have been able to furnish a scientific explanation for the old axiom for a man with an allergy to wheat was really being poisoned by what was generally regarded as a wholesome food for everyone.

Some recent work has thrown further light on the subject of individual food habits and health. In one piece of research it was shown that small children who were allowed to select their own food did as well or better than those whose diet was carefully ordered for them. In other words, if adequate amounts of adequate foods were provided, the individual would normally choose an adequate diet for health and growth. A little reflection shows that this would be the result, as the appetite is an automatic, physiological device for the purpose of obtaining the food necessary for well-being.

A second blow to the "Eat Your Spinach" doctrine comes from a study of 1,028 British children during the years 1935-39. Boys and girls in equal numbers and of all age groups from 1 to 18 years were represented. There were 112 diabetics or children of diabetic ancestry. All food was weighed weekly. Hemoglobin levels and dental caries studied. This work was published by the Medical Research Council and has been done by E. M. Widdowson, of the University of Cambridge (Special Report Series No. 257). The last paragraph in the summary of the report is most significant, and is quoted verbatim (p. 178):

"The one outstanding fact, which has been brought out again and again by this investigation, is that similar individuals may differ enormously and unpredictably in their food habits. This applies with great force to the energy value of the diets, but it is equally true of the proximate principals, minerals and vitamins, and still more true of the foods themselves. These extraordinary departures from the average are compatible with normal physical development. These findings indicate that individual requirements must differ as much as individual intakes, and that an average intake, however valuable statistically, should never be used to assess an individual's requirement."



THE SINS OF MASS SEROLOGY

One of the outstanding features of the last few years in the history of the diagnosis and treatment of syphilis is the growth of discontent with serological reactions as a diagnostic test. Particularly is this discontent manifested toward their use on a mass scale and the tendency to give them undue emphasis in the diagnosis of syphilis.

This dissatisfaction is due in great part to the failure of serological tests in specificity resulting in a great many false positive tests. Failure to properly evaluate the test in relation to the presence or the absence of other evidence of syphilis is another cause of a revolt among many medical men against the large-scale use of serological tests. Barnard in *The Ohio State Medical Journal* for March 1947 states that as a result "of certain misconceptions in the import of the serologic tests, many thousands of individuals have been subjected to needless treatment, indignity and mental suffering; homes have been disrupted and lives wrecked." Others are equally emphatic.

It would seem that two factors have been at work to produce so many false positive reactions. In the first place, serologists have increased the delicacy of the test, and secondly the population has been exposed to more vaccinations, acute exanthems and tropical diseases, all of which are known to produce false reactions.

It is certainly not desirable to give up valuable biologic tests but it seems to be a time for every medical man to be more cautious in the interpretation of them; be sure that they do not represent a false reaction; and given their proper weight in connection with other signs and symptoms.



NAVAL MEDICAL JOURNALS

Journals devoted principally to naval medicine are published in a number of countries. Many of these are received, usually by exchange, by the UNITED STATES NAVAL MEDICAL BULLETIN. The following list, while it is possibly not complete, has been compiled with some care and is an attempt at a bibliography of present-day periodical publications in the field of naval hygiene. The names of the journals and the countries printing them are given below:

United States Naval Medical Bulletin-----	The United States.
Military Surgeon. (Contains some articles on naval medicine.)	The United States.
Journal of the Royal Naval Medical Service.	Great Britain.

Revue de Médecine Navale (Métropole et Outre-Mer)-----	France.
Bulletin International des Services de Santé des Armées de Terre, de Mer et de l'Air. (Official journal of the International Committee of Military Medicine and Pharmacy.)	Belgium.
Arquivos Brasileiros de Medicina Naval---	Brazil.
Revista Española de Medicina y Cirugia de Guerra. (Contains occasional articles on naval medicine.)	Spain.



CORRECT DIAGNOSES OF CLINICAL CASES

The correct diagnoses of the dermatological cases on page 434 of this BULLETIN.

Case 1.—Mollusca contagiosa (a benign, localized, transmissible, epithelial tumor due to a filtrable virus).

Case 2.—Lichen planus, partly vesicular.



MEDICAL AND DENTAL OFFICERS

*Whose Deaths Have Been Reported Since
the Last Issue of the Bulletin*

FOUGEROUSSE, HENRY LOUIS, Captain (MC) U. S. N. (Retired, Inactive). Died 13 April 1948 at U. S. Naval Hospital, San Diego, Calif.

JONES, EDWIN LEE, Commander (MC) U. S. N. (Retired). Died 17 April 1948 at U. S. Naval Hospital, Houston, Tex.

KENNEDY, JOHN TIMOTHY, Commander (MC) U. S. N. (Retired, Inactive). Died 3 May 1948 at U. S. Naval Hospital, Portsmouth, N. H.

MANGOLD, MARSON WALTON, Captain (DC) U. S. N. (Retired, Inactive). Died in Washington, D. C., 14 April 1948.

ROBERTSON, GARDNER ELLIS, Captain (MC) U. S. N. (Retired, Inactive). Died 27 March 1948 at St. Petersburg, Fla.

CLINICAL NOTES



SULFADIAZINE ANURIA

Its Relief by Bilateral Renal Decapsulation and Nephrostomy¹

CLIFFORD F. STOREY

Captain (MC) U. S. N.

and

JOHN A. FOWLER

Lieutenant, junior grade (MC) U. S. N. R.

Only 15 case reports have appeared in the English literature, as far as we have been able to ascertain, of patients who have undergone surgical intervention for anuria resulting from administration of the sulfonamides; doubtless numerous others remain unpublished. The purpose of this paper is to report an additional case and to invite attention again to the value of surgery in this disorder when other recognized remedial measures have proved ineffective. Despite the newer antibiotics the sulfonamides remain therapeutically powerful drugs of inestimable value and their large-scale employment in a variety of conditions will doubtless continue; any procedure that may even occasionally be of value in the management of the complications that not infrequently arise following the exhibition of these agents deserves a place in our armamentarium. We realize that the operation of renal decapsulation has fallen into considerable disrepute in recent years, perhaps largely because of its improper employment, but we would like to reiterate the well-known yet oft-forgotten fact that no procedure can properly be condemned because it is used promiscuously, ineptly, or unwisely.

The symptom-complex of microscopic and gross hematuria, crystal-luria, abdominal and flank pain, decreased urinary output, nausea and vomiting, azotemia, and finally anuria following sulfonamide therapy became an established entity as early as 1940 and since that time the literature records many case reports of fatalities resulting from this syndrome. Relief is usually afforded by immediate withdrawal of the

¹ From the Surgical Service, U. S. Naval Hospital, Corpus Christi, Tex.

drug, the forcing of fluids to optimum amounts, adequate alkalinization of the urine, and, when prompt response to these conservative measures is not obtained, retrograde catheterization of the ureters. Such therapy was instituted in most of the fatal cases which have been reported, indicating that in certain instances more heroic steps need be taken.

It is commonly accepted that the renal complications of sulfonamide therapy are due to the poor solubility of these drugs or their acetyl derivatives. However, the pathogenesis of the resulting anuria is not clearly understood and the exact mechanism whereby it arises has been the subject of much discussion and investigation. Two fairly distinct pathological types have been described (Abeshouse and Tankin (1)): The mechanical type is believed to be due to the occlusion of the upper or lower urinary tract by crystals or concretions, whereas the chemical type, which has been referred to as "calcifying nephrosis" (Antopol) or "sulfa-nephrosis" (Wattenberg and Coleman), is considered the result of an acute toxic and degenerative lesion of the renal tubules similar to that seen in the toxic nephrosis following poisoning with bichloride of mercury. In the early stages there is acute cloudy swelling with desquamation of the tubules which progresses in the terminal stages to severe degenerative and necrotic changes in the tubular epithelium. The two processes may occur singly or simultaneously; the type predominating may be readily established by ureteral catheterization. Should the anuria prove to be on the basis of mechanical obstruction this diagnostic step will generally produce prompt relief, but that such a happy result cannot invariably be anticipated is demonstrated by the fact that death has occurred in sulfonamide anuria with ureteral catheters in place.

The employment of surgery in the treatment of anuria resulting from sulfonamide medication was first reported by Smith, Evelyn and Nolan (15) in 1940. Bilateral decapsulation, pyelostomy, and retrograde ureteral catheterization was done in their case. Abeshouse and Tankin (1) reviewed the literature up to 1944 and tabulated the reports of 10 cases that had been treated by various operative procedures, all of them successful. Since that time we have found reports of 5 additional cases. Surgery was used with success in three of these cases while in the remaining two death occurred. In Fletcher's (6) case of anuria following treatment with sulfapyridine, unilateral decapsulation and pyelostomy were of no avail; autopsy findings were not given. Bilateral decapsulation and pyelostomy failed to afford relief in the second fatal case, in which sulfadiazine was the responsible agent. In this case, reported by Abeshouse and Tankin (1), post-mortem examination revealed hemorrhagic infarction of the kidneys and thrombosis of both renal arteries. Pertinent data on the reported cases treated

surgically are tabulated in table 1 (Abeshouse and Tankin (1) with additions).

TABLE 1

Year	Author	Drug	Operative procedure
1940	Smith, Evelyn, & Nolan	Sulfapyridine	Bilateral pyelostomy, decapsulation, and retrograde ureteral catheterization.
1940	Gonzalez Mac-Oliver	do	Decapsulation and ureteropyelostomy.
1941	Fletcher ¹	do	Unilateral decapsulation and pyelostomy.
1942	Bynum, Joyce, & Pyle	Sulfathiazole	Decapsulation.
1943	Wattenburg & Coleman	do	Bilateral decapsulation.
1943	Weinstein & Adams	do	Unilateral decapsulation and nephrostomy.
1943	DeLacey, Cohen, & Spencer	Sulfapyridine	Nephrostomy.
1943	Campbell & Fobes	Sulfadiazine	Unilateral ureteropyelostomy.
1944	King Lewis	Sulfapyridine	Unilateral decapsulation and nephrostomy.
1944	Skibba	Sulfathiazole	Unilateral decapsulation and biopsy.
1944	Marquardt	do	Do.
1944	Murphy	do	Unilateral decapsulation and pyelostomy.
1945	Smiley	Sulfadiazine	Unilateral nephrostomy and pyelostomy.
1946	Kleiman	Sulfathiazole	Unilateral decapsulation.
1946	Abeshouse & Tankin ¹	Sulfadiazine	Bilateral decapsulation and pyelostomy with retrograde ureteral catheterization.
1947	Storey & Fowler	do	Bilateral decapsulation and nephrostomy.

¹ Fatal cases.

The mechanism by which decapsulation alone or in combination with nephrostomy or pyelostomy relieves urinary suppression remains in the field of speculation. Lowe (10) has recently enumerated the numerous theories which have been advanced to explain the beneficial effects frequently obtained as a result of these procedures when utilized in the treatment of anuria from various toxic agents. The appearance of tense swollen kidneys and bulging of the renal parenchyma at capsulotomy has led many to believe that the operation relieves intrarenal pressure. Culpepper and Findley (4), on the other hand, placing emphasis on tubular lesions, state that "although it is attractive (intrarenal pressure) the actual basis seems slim * * * diverse etiologic factors produce anuria chiefly by the same fundamental mechanism, that is, increased tubular reabsorption of glomerular filtrate." Likewise, Wattenberg and Coleman (17) labeled their case "sulfanephrosis" and explained the anuria on the basis of tubular pathology. On the other hand, Weinstein and Adams (16), having demonstrated concretions within the tubules, postulated the theory that the anuria was an obstructive phenomenon. As previously noted, there is good evidence to support the opinion that either mechanism or a combination of the two may prevail in any given case.

In anuria resulting from obstruction of the lower urinary tract by sulfa crystals or concretions the reasons underlying the therapeutic effectiveness of the surgical procedures under discussion are obvious, but in the chemical nephrosis the rationale for success following decapsulation is shrouded in mystery and will probably so remain until the basic renal pathology is more clearly defined. That the partial renal denervation which occurs during the procedure, consisting of an interruption or destruction of the sympathetic nerve connections be-

tween the kidney capsule and cortex, causes a resumption of the urinary flow through improvement of the circulation and secretory function is a plausible theory which appears to have some merit.

CASE REPORT

D. B., a white male 23 years of age, was admitted on the urological service at the U. S. Naval Hospital, Corpus Christi, Tex., at 1600 on 2 August 1946 with a history of anuria of 2 days' duration. On 25 July his family physician had prescribed sulfadiazine for gonococcus infection of the urethra. He received an initial dose of 4 grams and 2 grams every 4 hours thereafter. No alkalinizing drug was prescribed and no instructions relative to fluid intake were issued. On 31 July he developed periumbilical cramping pain, nausea, vomiting, and oliguria, at which time he discontinued his own medication. On 1 August the patient passed grossly bloody urine and thereafter was anuric. At this time he went to a "health clinic" and stated his history whereupon he was given one intramuscular injection of penicillin. The remainder of his history was essentially noncontributory.

On admission the patient's temperature was 99.8° F., pulse 90, respiration 18. His blood pressure was 130/98. Physical examination was essentially negative except for tenderness over each costophrenic region and bilateral flank pain.

He was catheterized but only a few drops of bloody urine could be obtained. Fluids were forced by mouth and the intake supplemented by the administration of 10 percent dextrose in distilled water and one-sixth molar sodium lactate intravenously. Cystoscopy was performed 5 hours after admission. The bladder contained a few drops of blood but no urine. An attempt to pass ureteral catheters was unsuccessful because of an obstruction met just within each ureteral orifice in the intramural portion of the ureter at about the ureterovesical junction. The typical "sheaves of wheat" appearance of sulfa crystals frequently seen presenting at the ureteral orifices in case of obstruction of the lower urinary tract were not observed, possibly being obscured by the moderate bleeding noted at each orifice, consisting of small quantities of bright red blood admixed with dark clots. During the evening a high fluid intake and alkalinization were continued but urinary excretion was not resumed.

At 0300 on 3 August a second cystoscopy was done under spinal anesthesia but ureteral catheters could not be passed beyond the point of obstruction in spite of alkaline irrigation through the partly introduced catheters and the use of various sized catheters ranging from 4 F. to 10 F., used with and without stylets. Neither would ureteral bougies pass. Fluids and alkalis were continued, chiefly by the intravenous route, and at 0800 on the same date a third cystoscopy was performed and an equally unsuccessful attempt made to pass ureteral catheters. The nonprotein nitrogen at this time was 76 mg. percent and the blood urea nitrogen 30 mg. percent. The blood pressure was now 150/120.

By 1200 on 3 August the patient had received 3,000 cc. of fluids intravenously in addition to a rather large oral intake since entering the hospital, yet he remained completely anuric. His nonprotein nitrogen had risen to 93 mg. percent and his blood pressure was 182/124. Peripheral edema had appeared, giving rise to a generalized puffiness of his features most noticeable in the periorbital area. He was becoming disoriented and confused and his temperature had risen to 103.2° F. At this point a fatal outcome appeared imminent and in spite of his critical condition a decision in favor of surgical intervention was reached.

At 1300 on the same date, when the anuria was of approximately 79 hours' duration, bilateral renal decapsulation and nephrostomy was performed by the usual

technique under spinal anesthesia. Both renal pelves were found tensely distended and contained a dirty brownish-black urine and much cellular debris. Both kidneys were moderately distended and there was a marked bulge of renal parenchyma through the incised capsule on capsulotomy. Biopsies were not taken. Urine specimens obtained from the pelves showed innumerable blood cells and countless degenerated cellular elements; no sulfonamide crystals were noted. As the skin incisions were being closed urine was flowing freely from each side.

Immediately following the operation there was free drainage from each nephrostomy tube. By the second postoperative day the blood nonprotein nitrogen had dropped to 39 mg. percent. He was mentally clear, all flank pain had disappeared, and the blood pressure had fallen to 130/90. On the third day the patient voided grossly bloody urine which rapidly cleared in appearance. On the fourth postoperative day methylene blue was successively injected into each nephrostomy tube and on both occasions it promptly appeared in the voided specimens. The nephrostomy tubes were removed on the ninth postoperative day. Two weeks after operation dilution and concentration urinary function tests were normal. PSP test revealed a total excretion of 65 percent of the dye in 2 hours, 55 percent in the first hour and 10 percent in the second. Intravenous urograms showed prompt appearance of the dye in each kidney pelvis but the right renal pelvis was not clearly outlined.

At this time the patient developed right loin pain and a spiking temperature. Radiographic examination revealed obliteration of the right psoas shadow and the diagnosis of a right perinephric abscess was made. Incision and drainage was promptly carried out and uneventful healing ensued. In addition to the findings indicative of a perirenal abscess, the same films had also shown a large irregularly ovoid calculus in the upper third of the right ureter. Therefore, at the time that the abscess was drained, cystoscopy was performed and a ureteral catheter was easily passed beyond the calculus into the right renal pelvis. It was left in situ for 7 days and following its withdrawal x-rays failed to reveal the previously noted stone. Shortly thereafter the patient voided a large amount of whitish precipitate and several sizeable concretions which were chemically identified as containing urate, phosphate, calcium, ammonium, and sulfonamide.

Prior to his discharge a thorough investigation of the patient's renal function by a variety of standard tests revealed no impairment. His blood pressure and blood chemistry were normal. He was symptom-free and all physical findings were within normal limits. In a follow-up interview several months later it was learned that the patient had remained well and that very recently, after unusually complete studies of renal function, he had been accepted for enlistment in the Navy.

SUMMARY

1. A case of anuria following sulfadiazine therapy relieved by bilateral decapsulation and nephrostomy is reported.
2. Anuria caused by the sulfonamides may be due to either of two pathological types or to a combination of them.
3. A review of the literature reveals a total of 16 cases, including the one reported herein, where surgery was employed in the treatment of anuria consequent to the sulfonamides. In 14 instances (87.5 percent) a successful outcome ensued.
4. In the occasional case where adequate fluid intake, effective alkalization and ureteral catheterization, including alkaline lavage via

the catheter, fail to restore renal function after adequate trial, operative intervention will be necessary to prevent death from uremia.

5. The mechanism whereby decapsulation alone or in combination with nephrostomy or pyelostomy, with or without retrograde ureteral catheterization, restores renal function in this disorder has not been satisfactorily explained.

CONCLUSIONS

We most emphatically do not advocate the hasty employment of surgery in the treatment of sulfonamide anuria, as it has been our experience that the vast majority of patients with this condition will respond to the conservative measures which we have mentioned. On the other hand we are of the opinion that timely surgical intervention may be lifesaving in the occasional case which fails to respond to these measures. Admittedly, the time to intervene is difficult to decide, requiring the closest clinical observation of the patient hour by hour and the employment of one's keenest surgical judgment.

REFERENCES

1. ABESHOUSE, B. S., and TANKIN, L. H.: Renal complications of sulfonamide therapy. *J. Urol.* **56**: 658-687, Dec. 1946.
2. BYNUM, W. T.; JOYCE, F. T.; and PYLE, O. S.: Anuria following administration of sulfadiazine and sulfapyridine. *J. Oklahoma M. A.* **35**: 145-147, Apr. 1942.
3. CAMPBELL, M. F., and FOBES, J. H.: Sulfadiazine anuria; its relief by ureteropyelostomy. *Am. J. Surg.* **61**: 99-102, July 1943.
4. CULPEPPER, W. S., and FINDLEY, T.: *Am. J. M. Sc.* **214**: 100, 1947.
5. DELACEY, G.; COHEN, R. H. L.; and SPENCER, J.: Sulphapyridine anuria treated by unilateral nephrostomy. *Lancet* **1**: 74-75, Jan. 16, 1943.
6. FLETCHER, F. R.: Fatal anuria following sulphapyridine in pneumonia. *Brit. M. J.* **1**: 242, Feb. 15, 1941.
7. GONZALEZ MAC-OLIVER, R.: Infecciones peri-renales. *Rev. med. de Chile* **68**: 21-29, Jan. 1940.
8. KING LEWIS, F. L.: Sulphapyridine anuria treated by unilateral renal decapsulation. *Lancet* **1**: 247, Feb. 19, 1944.
9. KLEIMAN, A. H.: Sulfathiazole anuria with recovery following renal decapsulation. *J. Urol.* **56**: 598-601, Nov. 1946.
10. LOWE, E. S.: Renal decapsulation in treatment of oliguria and anuria. *U. S. Nav. M. Bull.* **47**: 959-964, Nov.-Dec. 1947.
11. MARQUARDT, C. R.; COOK, H. E.; and FREDERICK, A. J.: Anuria; report of 4 cases, 3 treated by kidney decapsulation. *Wisconsin M. J.* **43**: 1218-1221, Dec. 1944.
12. MURPHY, F. D. (Milwaukee); KUTMA, J. F.; POLLEY, T. Z.; and GRILL, J.: Clinicopathologic studies of renal damage due to sulfonamide compounds; report of 14 cases. *Arch. Int. Med.* **73**: 433-443, June 1944; abstr., *Renal damage due to sulfonamides. J. A. M. A.* **124**: 799-800, Mar. 18, 1944.
13. SKIBBA, J. P.: Sulfonamide anuria treated by unilateral renal decapsulation. *Wisconsin M. J.* **43**: 1215-1218, Dec. 1944.
14. SMILEY, L. V.: Suppression of urine complicating sulfadiazine therapy. *U. S. Nav. M. Bull.* **44**: 328-332, Feb. 1945.

15. SMITH, E.; EVELYN, K. A.; and NOLAN, J. F.: Anuria caused by sulfapyridine therapy (report of case successfully treated by operation). *Canad. M. A. J.* 42: 27-29, Jan. 1940.
16. WEINSTEIN, M. L., and ADAMS, E. L.: Sulfathiazole anuria cured by decapsulation of kidneys; case report. *Am. J. Surg.* 60: 105-111, Apr. 1943.
17. WATTENBERG, C. A., and COLEMAN, R. C., JR.: Sulfathiazole toxic nephrosis and kidney decapsulation. *Surgery* 14: 570-573, Oct. 1943.



DISCUSSION OF PULMONARY TUBERCULOSIS TREATED WITH PHRENIC CRUSH AND PNEUMOPERITONEUM THERAPY

Report of Two Cases

JERRY J. ZARRIELLO

Lieutenant, junior grade (MC) U. S. N. R.

Pneumoperitoneum, the injection of gas (usually air) into the peritoneal cavity, is not a new procedure. It was employed in the early 1900's for diagnostic purposes and for treating intestinal and peritoneal tuberculosis. In 1930, Richard H. Overholt (1) proved that by injecting air into the abdominal cavities of dogs the diaphragm could be elevated and partially fixed, thereby reducing pulmonary ventilation.

Since 1930 it has been used to a greater extent in the treatment of pulmonary tuberculosis. The value of this type of collapse therapy is gaining recognition and it is slowly taking its place among the therapeutic measures employed in the treatment of pulmonary tuberculosis. At the present time, pneumoperitoneum therapy is still in its infancy. Its place is now comparable to that held by pneumothorax therapy in the treatment of pulmonary tuberculosis 25 years ago. The scope and extent of pneumoperitoneum is, as yet, not too widely known; a brief discussion of this type of therapy will be given and its practical application will be demonstrated in the two cases that are herein presented.

INDICATIONS FOR PHRENIC CRUSH AND PNEUMOPERITONEUM

The literature was reviewed, and a summary of the more important indications for phrenic crush and pneumoperitoneum in the treatment of pulmonary tuberculosis will be enumerated and briefly discussed.

1. Tuberculous patients for whom no other collapse therapy is applicable because of: (a) advanced age; (b) general debility; (c) low

vital pulmonary capacity; or, (*d*) because of advanced stage of pulmonary tuberculous involvement.

2. Bilateral pulmonary tuberculosis cases that are not amenable to the benefits of pneumothorax therapy because of adhesions or contralateral collapse. By virtue of the elevation of both domes of the diaphragm, pneumoperitoneum creates a favorable condition for healing tuberculosis of both lungs.

3. Unilateral pulmonary tuberculosis cases that are too acute for thoracoplasty and in which pneumothorax therapy has been unsuccessful. Pneumoperitoneum is a reversible operation that can be adapted to the individual case and discontinued at any time during treatment, should it prove ineffective. Pneumoperitoneum may be used for an interim measure, directed specifically toward cavity closure. Fowler (2) felt that the true value of pneumoperitoneum is found in its effectiveness in so improving the patient's general condition as to make him a candidate for some other form of treatment; most chest physicians would agree with this conclusion.

4. Predominantly basal tuberculous cases. Since the lower lobe is in direct contact with the diaphragm and, as it follows the respiratory excursions of this muscle, it moves to a greater extent than the upper lobe. Consequently, one may anticipate good results in lower lobe disease treated with phrenic surgery and pneumoperitoneum because of restriction of the motion of the diaphragm and compression of the diseased area.

5. Cases that have been subjected to phrenic surgery but which require further elevation of the diaphragm for effectiveness.

6. Cases of uncontrollable pulmonary hemorrhage that are not amenable to pneumothorax therapy or in which the site of hemorrhage cannot be located with certainty on either side (6).

7. Mason (3) has stated that tuberculous pneumonias demand pneumoperitoneum treatment alone, if any form of collapse therapy is considered.

BENEFICIAL RESULTS

The advocates of pneumoperitoneum claim that beneficial results are due to:

1. Elevation of both hemidiaphragms, giving rest to the diseased lung. Banyai (4) states that elevation of the diaphragm implies that the intrapleural pressure becomes less negative. The latter change permits a greater contraction of the elastic structures of the lung in the direction of the hilum. This leads to decreased stretching of lung tissue. The pulmonary relaxation attainable is assumed to be sufficient to improve resistance, defense, and repair capacity of the lung, and thus aids in the healing process of tuberculosis lesions. It is also assumed that the decrease in roentgenologic surface area reflects

the degree of pulmonary relaxation induced; the latter is assumed to be a most important therapeutic factor.

2. Lymph stasis, which, in turn, promotes tissue fibrosis.

3. Pulmonary congestion and anoxemia which, in turn, inhibit the growth of tubercle bacilli in the tissues and hasten reparative processes.

4. Alteration of the mechanics of the bronchus leading to the cavity, resulting in closure of the cavity. Pneumoperitoneum has a definite role in compression therapy; it reduces the volume of the diseased lung and basically represents the same mechanical principles as do other forms of collapse therapy.

5. By the use of pneumoperitoneum, we find that:

(a) The pressure is directed from below, upward, and against an unyielding costal and intercostal framework.

(b) A cavity held open by apico-mediastinal adhesions is relaxed rather than put on tension.

(c) A large amount of air in the peritoneal cavity exerts an indirect pressure upon the lung through the means of the diaphragm.

(d) Compression takes place without the separation of the lung from any of its protective or surrounding structures; this helps to eliminate the risk of fluid formation, empyema, traumatic pneumothorax, and bronchopleural fistula.

(e) The amount and duration of compression seems to be entirely controllable and can be completely reversed at once.

(f) Complete collapse of the lung is reduced to a minimum.

6. Favorable symptomatic response has been noted by many clinicians, early during the course of treatment, in many instances. The most impressive manifestations were lessening of the severity and frequency of cough and easier expectoration. This is conjectured to be brought about by elevation of the diaphragm and its support, in a bracelike fashion, during periods of coughing. The improved pulmonary drainage was followed by a decrease in toxicity and constitutional symptoms.

DANGERS AND CONTRAINDICATIONS

The technique of pneumoperitoneum administration will be described adequately elsewhere in this paper. However, the more important dangers and difficulties, in regard to the use of this therapy, are:

1. The usual water manometer is not sufficiently sensitive to give an accurate gage and the variation and fluctuation of the intra-abdominal pressure.

2. The possibilities of air embolism, air injected into the spleen, peritonitis, subcutaneous emphysema, and perforation of the bowel.

3. Trimble, Eaton, and Moore (5) state that prolonged, continued pneumoperitoneum caused definite peritoneal irritation and occasional

formation of ascites, analogous to formation of effusion during the course of pneumothorax treatment.

4. Banyai (4) states that the contraindications to pneumoperitoneum in the treatment of pulmonary tuberculosis are: Generalized tuberculosis, amyloidosis, diseases of coronary artery and aorta, cardiac decompensation, plastic peritonitis, diaphragmatic fixation, thick and rigid-walled cavities, and low vital capacity.

TECHNIQUE

No statistical data on a number of cases treated, and the results obtained, will be presented, but two cases shall be described in which phrenic surgery, combined with pneumoperitoneum and concurrent with bed rest, have brought about relatively dramatic roentgenographic cavity closures and sputum conversions.

The technique used in administration of initial pneumoperitoneum is, briefly, as follows:

The left upper quadrant is used for the site of injection. The skin is sterilized with tincture of merthiolate. Then the patient is draped with a sterile sheet; this sheet has an opening in it through which the prepared area of skin can be reached. With strictly aseptic technique, the skin and subcutaneous tissues are anesthetized with 1 percent sterile solution of novocaine, using a No. 27 needle. Careful infiltration of the peritoneum is then done.

Now the skin is nicked with a sharp scalpel, and a 2½-inch blunt No. 18 needle is inserted. When the point of the needle has reached the peritoneal cavity, the administration of air begins in the same fashion as when giving artificial pneumothorax.

Certain subjective symptoms can be used as indicators of well-administered artificial pneumoperitoneum. These include shoulder pain, epigastric pain, and abdominal discomfort. The objective signs of air in the abdomen are well-known and will not be reviewed. Each patient is fluoroscoped prior to receiving air refills.

The above procedure was followed in the treatment of the two cases presented in this paper.

CASE REPORTS

Case 1.—P. F., a young, colored male, was admitted to Corona Naval Hospital on 30 July 1945 with a diagnosis of Pulmonary Tuberculosis, active, reinfection, far advanced. At time of admission, his symptoms were cough, daily expectoration of one-half ounce of nonbloody, nonfoul, yellowish-white, tenacious sputum, 15-pound weight loss, and night sweats. No pleuritic pains noted. No history of a known tuberculous contact. Abnormal physical findings were confined mainly to the chest; there was a slight increase in tactile fremitus and slight increase in dullness over left upper lung. Numerous fine to medium-sized posttussive rales heard over left upper lung field. Right lung was clear to auscultation and percussion. Admission temperature was 99.8° F. His sputum was strongly positive for tubercle bacilli (numerous tubercle bacilli found per high power field on 31 July

1945); sedimentation rate was markedly elevated, being 25 mm/hr on 31 July 1945; X-ray revealed soft, mottled infiltrations throughout left upper lobe and left base, with small cavity in the first left anterior intercostal space. Right lung clear.

In view of roentgenographic evidence of cavity, and positive sputum revealing tubercle bacilli, a left pneumothorax was instituted on 5 August 1945 with initial injection of 200 cc. followed by refills of 300 cc. to 500 cc. on the 2 succeeding days. Gradually, he was placed on weekly refills of 500 cc. injected into the left pleural cavity. Chest x-ray, taken in the latter part of August 1945 revealed a 30 percent collapse of the left lung with a 3 cm. cavity in the left apex, and with a 1 cm. cavity in the second anterior left intercostal space. Fine, small multiple adhesions were present at the apex and laterally. It was believed, at this time, that the patient had a check-valve cavity in the left apical region. Sputum continued to be highly positive for tubercle bacilli (numerous tubercle bacilli found per high power field). A left phrenic crush was performed in September 1945 in an effort to relax the lung and, possibly, mechanically alter the position of the draining cavitory bronchus; it was felt that this effect might, in turn, alter the check-valve mechanism. The cavities were found to be still patent and somewhat larger despite satisfactory paralysis of the left diaphragm. In November 1945 a left closed pneumonolysis was performed and all adhesions were severed. This procedure did not change the appearance of the cavities which continued to remain patent. Expectoration of $\frac{1}{2}$ to 1 ounce of yellowish-white sputum persisted, and clinical course was a low febrile one with temperature varying from 99° to 101° F.

In December 1945 pneumoperitoneum therapy was instituted in the usual manner, with 500 cc. of air injected into the peritoneal cavity. Initial pressures were positive with satisfactory oscillations. Refills were given 3 days in succession and, after pneumoperitoneum was established, refills were gradually reduced from 800 cc. of air twice a week to 1,000 cc. of air once a week. At this time, it was noted that the function of the left diaphragm was returning; this was ascertained fluoroscopically. Therefore, in January 1946 the left phrenic crush operation was repeated. Sputum was still highly positive and the pneumothorax therapy was abandoned. The cavities were still patent. Fluoroscopy and roentgenography showed that as the lung reexpanded and the degree of pneumoperitoneum increased, the larger cavity gradually became smaller. This cavity finally closed completely roentgenographically, and was officially reported as closed by the roentgenologist. Sputum conversion was obtained in March 1946. Serially repeated concentrated sputum and gastric examinations, since that time, have been negative for tubercle bacilli. His sedimentation rate had declined to a normal range and last sedimentation rate in July 1946 was 6 mm/hr. Associated with cavity closure was a weight gain of 20 pounds and return of temperature to normal. In August 1946 at the time of his transfer to another hospital for further treatment, he was completely asymptomatic.

Case 2.—E. H., a young, colored male, was admitted to Corona Naval Hospital in October 1945 with a diagnosis of Pulmonary Tuberculosis, re-infection, active, far advanced. His symptoms were cough, productive of blood-streaked sputum, fever, and weight loss of 12 pounds. These symptoms were of approximately 4 months' duration and were progressively increasing in severity. Physical findings consisted of fever (102° F.), occasional moist, medium-sized, posttussic rales in the left midlung field, with bronchial breathing anteriorly.

On admission, his sedimentation rate was 24 mm/hr, and his sputum was strongly positive (numerous tubercle bacilli per high power field). X-ray revealed a large oval cavity, measuring 3 by 4 cm. in the left hilum, with a small amount of infiltrative process around the cavity. A thin, patchy infiltration was

present at the level of the first and third anterior intercostal spaces. In view of the large cavity in the left hilar area and positive sputum for tubercle bacilli, a left pneumothorax was advised. This therapy was then attempted on several occasions, but these attempts were not successful.

A left phrenic crush was performed in November 1945 followed by institution of pneumoperitoneum in the usual manner. 500 cc. of air were injected into the peritoneal cavity on 3 successive days, then refills of 1,000 cc. were given twice a week. Refills were gradually reduced to 1,000 cc. of air once a week. An abdominal binder was applied to reinforce the pneumoperitoneum.

On serial x-ray it was noted that the cavity at the medial end of the left second rib became compressed, smaller, and finally closed as the degree of pneumoperitoneum increased.

Under this regimen, the sedimentation rate came down to normal levels, and repeated concentrated sputum and gastric examinations failed to reveal tubercle bacilli; these have remained negative since the early part of February 1946. These were also associated with clinical improvement.

SUMMARY

Because of the chronic nature of the disease, short period of observation, and failure to fulfill the criteria of the National Tuberculosis Association for arrested diagnosis, the cases are presented, primarily, from the standpoint of interest and, secondarily, to show the closure of relatively large cavities roentgenographically through the use of phrenic crush and pneumoperitoneum therapy. No other conclusions can be drawn from these cases, and no attempt is made to show the efficacy of one form of collapse therapy over another. However there are certain limited indications for pneumoperitoneum therapy, and it may be instituted in a small percentage of tuberculous patients. It must be emphasized that artificial pneumothorax collapse of the lung is still the operation of choice; the most complete and satisfactory type of pulmonary compression is obtained by this method. It is only if this method fails, or, when some other contraindication prevents its use, that pneumoperitoneum has been used, as exemplified in the two cases described in this paper. It is believed that pneumoperitoneum therapy should have a place in the armamentarium of the chest physician.

REFERENCES

1. OVERHOLT, R. H.: Air in peritoneal cavity; its effect on position and activity of diaphragm. *Arch. Surg.* 21: 1282-1290, Dec. (pt. 2) 1930.
2. FOWLER, W. O.: Therapeutic pneumoperitoneum in treatment of pulmonary tuberculosis and its role in scheme of collapse therapy. *Nat. Tuberc. A. Tr.* 37: 142, 1941.
3. MASON, C. V.: Artificial pneumothorax for tuberculous pneumonias. *California & West. Med.* 57: 32-33, July 1942.
4. BANYAI, A. L.: *Pneumoperitoneum Treatment*. C. V. Mosby Co., St. Louis, Mo., 1946.

5. TRIMBLE, H. G.; EATON, J. L.; and MOORE, G.: Pneumoperitoneum in treatment of pulmonary tuberculosis; local effects on peritoneum. *Am. Rev. Tuberc.* **39**: 528-536, April 1939.
6. CLIFFORD-JONES, E., and MACDONALD, N.: Pneumoperitoneum in collapse therapy of pulmonary tuberculosis. *Tubercle.* **24**: 97-107, June 1943.



RUPTURE OF THE SPLEEN IN INFECTIOUS MONONUCLEOSIS

Report of a Case

SAMUEL P. HICKS¹

Lieutenant Commander (MC) U. S. N.

Rupture of the spleen complicating infectious mononucleosis has recently been brought into prominence by a report of seven cases from the Army Institute of Pathology by Smith and Custer (1). Four of their cases were fatal, three recovered after splenectomy. They also noted three other cases in the literature up to that time, two of which were fatal (2) (3) (4). Two other cases with recovery after splenectomy have also been reported (5) (6).

This complication is an important one to consider in the management of infectious mononucleosis for two reasons: (1) it has carried a high mortality thus far, and (2) rupture appears to occur after trivial injury, even after palpation of the spleen (1).

A case of rupture of the spleen following trauma, with recovery after splenectomy, is reported. Infectious mononucleosis was not apparent until after the rupture occurred.

CASE REPORT

An 18-year-old sailor developed an acute reactive depression when he saw a friend mangled to death by a boat propellor. He was admitted to the U. S. Naval Hospital, Bethesda, Md., in February 1946 for this mental condition.

On admission a physical examination, complete blood count, urine and stool examination, blood, sedimentation rate, blood Kahn test, and chest x-ray showed no abnormalities.

Part of his therapy consisted in helping orthopedic patients in the swimming pool and on the afternoon of 13 April 1946, while so occupied and apparently physically well, he fell and struck his left lower chest on a diving board. This afforded him severe pain at the time and a friend helped him out of the water, but the trauma was considered unimportant to him and he continued his activities. About 1 hour later he experienced severe general lower abdominal

¹ Resigned 17 February 1947.

pain which became increasingly severe and caused him to double up and become dyspneic. About 2 hours after the fall he fainted. X-rays of the chest and abdomen were negative at this time. He was not in evident shock; his blood pressure was 114/70, and his hemoglobin was 12 gm. By late evening, about 6 hours after the fall, his blood pressure had dropped to 92/68 and his hemoglobin to 10 gm. The three white blood counts during this period were about 12,000 and showed 75 to 80 percent polymorphonuclear leukocytes, but none of the mononuclear cells were considered abnormal. Rupture of the spleen was diagnosed and on 14 April 1946 splenectomy was performed.

At operation about 1,200 cc. of blood were present in the peritoneal cavity and three small lacerations of the capsule of the spleen were found on the hilar surface. The spleen weighed 480 grams.

A blood count done shortly after the operation showed 8 gm. of hemoglobin and a total white blood cell count of 6,000 whose differential was 46 percent segmented polymorphonuclear leukocytes, 17 monocytes, 3 eosinophils and 34 percent lymphocytes, many of which were atypical. Whole blood transfusions were given and the patient recovered rapidly from the effects of his ruptured spleen. On 24 April 1946 a total white blood cell count of 24,000 with 67 percent lymphocytes was recorded. Many of the lymphocytes were atypical. These atypical lymphocytes were considered to be compatible with infectious mononucleosis. A Davidsohn sheep cell agglutination test of the patient's serum on 2 May 1946 showed an agglutination of sheep erythrocytes in a dilution of 1:112. This titer of 1:112 remained the same after the serum was adsorbed on guinea pig tissue.

During June 1946, the patient exhibited recurrent episodes of hydrops of the knee joints, evident on x-ray, yet repeated blood counts, blood sedimentation rates, urine and stool examinations, and a Kahn blood test were unremarkable. There was no accompanying fever, tachycardia, malaise, or other evidence suggestive of an infectious process. This joint condition subsided clinically and by x-ray. By August 1946, he was considered mentally improved and physically well and was given an honorable discharge from the naval service. A relationship between his infectious mononucleosis, mental disease, and joint difficulties was not established.

Pathological examination of the spleen.—The spleen weighed 480 grams, but was otherwise usual in appearance except for three small lacerations on the hilar surface, each about 2 centimeters in length and involving only the capsule. A few flecks of fibrin and a trace of blood were evident on the margins of the lacerations. The organ was very firm but not fibrous and on gross section was not remarkable except for inconspicuous malpighian corpuscles. Microscopically the appearance of the lacerations confirmed the gross findings. The architecture of the parenchyma was still recognizable but the malpighian corpuscles were small and poorly defined, and the general pattern was made hazy by the presence of many loosely infiltrating mononuclear cells. These cells varied moderately in size, resembling large lymphocytes in hematoxylin and eosin preparations. Some had somewhat lobulated fairly dark staining nuclei. There were no tumor giant cells, nor was the picture that of a malignant lymphoma or leukemia. A sparsity of trabeculae was apparent. This microscopic picture is illustrated in the photomicrographs² (figs. 1 and 2).

² Photomicrographs by Dr. Ray Borland.

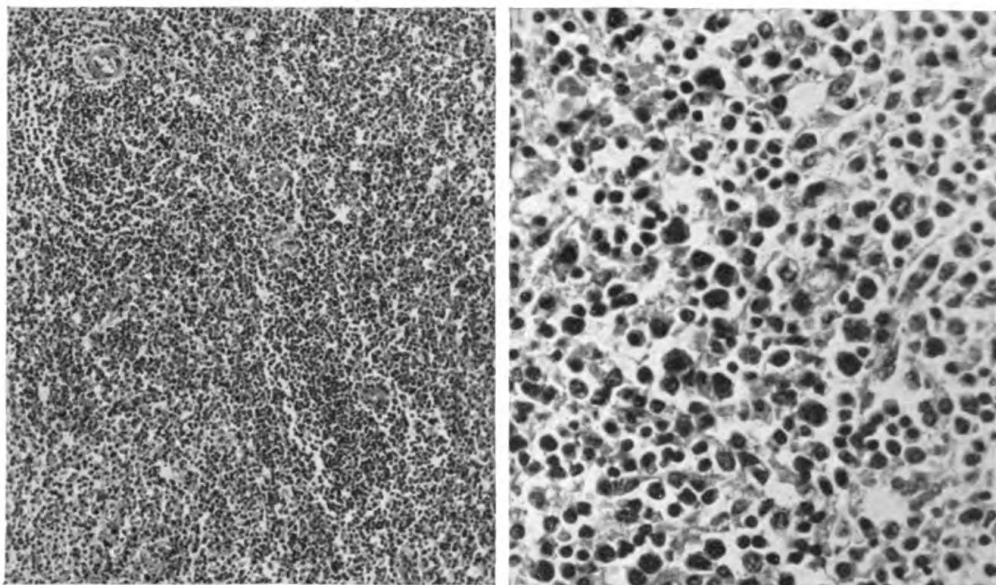


Figure 1.—Hematoxylin and eosin stain. Figure 2.—Hematoxylin and eosin stain.
X60. X400.

SUMMARY

A case of rupture of the spleen in unsuspected infectious mononucleosis, with recovery following splenectomy, is reported. The diagnosis was made from the pathologic examination of the spleen, the presence of atypical lymphocytes in the blood, and a sheep cell agglutination titer in the patient's serum of 1:112 which was unchanged by adsorption on guinea pig tissue (Davidsohn test). The high mortality in this condition and the possibility of inducing rupture by palpation of the spleen, as suggested by others, is reemphasized.

REFERENCES

1. SMITH, E. B., and CUSTER, R. P.: Rupture of spleen in infectious mononucleosis; clinicopathologic report of 7 cases. *Blood* 1: 317, 1946.
2. KING, R. B.: Spontaneous rupture of spleen in infectious mononucleosis; report of case. *New England J. Med.* 224: 1058-1060, June 19, 1941.
3. DARLEY, W.; BLACK, W. C.; SMITH, C.; and GOOD, F. A.: Spontaneous splenic rupture in infectious mononucleosis. *Am. J. M. Sc.* 208: 381-384, Sept. 1944.
4. ZIEGLER, E. E.: Infectious mononucleosis; report of fatal case with autopsy. *Arch. Path.* 37: 196-201, Mar. 1944.
5. DAVIS, J. S.; MACFEE, W.; WRIGHT, M.; and ALLYN, R.: Rupture of spleen in infectious mononucleosis. *Lancet* 2: 72-73, July 1945.
6. VAUGHAN, S. L., et al.: Infectious mononucleosis complicated by spontaneous rupture of spleen and central nervous system involvement. *Blood* 1: 325, 1946.



REITER'S DISEASE

A Review With Presentation of a Case

STEPHEN L. MAGIERA

Lieutenant, junior grade (MC) U. S. N. R.

Reiter (1), in 1916, first described a syndrome characterized by urethritis, conjunctivitis, and arthritis and which is not caused by gonorrhea. After his original report this condition was described in the literature occasionally, scattered reports appearing in Europe. The first report in American literature appeared in 1942 when Bauer and Engleman (2) reported 6 cases. In a recent review of the literature, Valee (3) has found a total of 151 cases reported. With the advent of large scale military medicine a great many more cases have been noted, and it is probable that this syndrome is much more frequent in occurrence than it is in recognition.

CLINICAL FEATURES

Clinically, the syndrome is usually ushered in by an acute, purulent urethritis which is followed by an acute conjunctivitis and an acute arthritis. This triad is a constant finding and serves as a basis for diagnosis. The urethritis is marked by a purulent discharge with burning on urination and local discomfort from the irritation produced. It is fairly transient lasting a few days or weeks. Conjunctivitis is noted by injection of the conjunctivae swelling and matting of the lids, and is also usually transient, passing away within a few weeks. The arthritis is the severe and debilitating part of the syndrome and is more persistent, lasting 2 to 3 months or longer. Any joint may be affected, the most common joints being the knees, ankles, hips, vertebrae, and the interphalangeal joints of the fingers and toes. The acute stage is manifested by swelling, redness, tenderness, and increased temperature of the affected joint, and fluid may accumulate into the joint space. Pain is severe and there is marked tenderness of joint and surrounding tissue with edema and limitation of motion. Adjacent muscle groups may become spastic and painful. The arthritic process in the bones may go on into a chronic stage with resulting degenerative changes. The syndrome is characterized by recurrences which may develop months or years after the original illness.

In a mild to moderate case of Reiter's disease there may be nothing more than the above-mentioned manifestations which may run a short, self-limited course. However, in the severe and complicated form a fever of variable degree may be present and prolonged, secondary anemia may occur, evidence of toxemia may arise, the patient exhibiting the effects of a debilitating disease. Severe ulcerative lesions of the

skin and mucous membranes may appear involving the palpebral conjunctivae, cornea, hard palate, pharynx, scrotum, penis, palms, and soles, and keratotic lesions with excoriation of the skin below the nail beds may develop. The mild conjunctivitis may spread to become a severe iritis and keratitis, and corneal ulcers and opacities may form. The urologic involvement may be attended by severe complications, the disease process extending up the genito-urinary tract to cause an acute prostatitis or a severe and stubborn cystitis. Colby (4) reports a case complicated by a hydronephrosis with a chronic right pyelonephritis, and another case with hematuria and renal dilatation. Reports of bleeding tendencies with disturbances of bleeding and clotting times have occurred. And as a further demonstration to the protean nature of this disease, Twiss and Douglas (5) recorded a case of Reiter's disease with generalized lymphadenopathy and an eosinophilia which could not be otherwise explained.

ETIOLOGY

The etiology of Reiter's syndrome remains unknown as no present, known organism has proved to be a demonstrable cause. Reiter in his work recovered a spirochaete from the blood and proposed this to be the etiological factor but his work has never been substantiated. A variety of etiological agents, including the spirochaete, filterable virus, staphylococcus, streptococcus, enterococcus, and the pleuropneumonia-like organism have been suspected, but all studies to establish one of these as the causative factor have been unsuccessful. The possibility of this being a deficiency syndrome has also been advanced but not verified. The disease with its manifestations is infectious in nature and perhaps further study will place it in the branching group of virus diseases. It is definitely not gonorrheal, and in the majority of reported cases no connection with sexual intercourse is recorded. In all probability the genito-urinary tract is the portal of entry although the gastro-intestinal tract is also considered since in a few cases the disease had its onset with diarrhea.

DIAGNOSIS

The diagnosis of Reiter's syndrome is based upon the clinical features that attend this disease. The triad of urethritis, conjunctivitis, and arthritis should arouse suspicion of the true diagnosis. In the acute stage a moderate elevation of the sedimentation rate may be found and a leukocytosis may be present, all other laboratory studies, including smears and cultures from the affected areas being negative. Roentgenograms of the affected joints show no significant change besides swelling and presence of joint fluid. The slow course of the disease and its poor therapeutic response together with the above make the

diagnosis certain. The diseases to be included in differential diagnosis are gonorrhea, rheumatic fever, gout, common types of infectious and nonspecific arthritis, and various local disorders of the genito-urinary tract, eyes, and skin, which may at times be predominantly severe and thus obscure the true diagnosis.

TREATMENT

Treatment of Reiter's disease is entirely symptomatic, no specific chemical or biologic agent being known. All therapeutic means that have been used, including sulfonamides, penicillin, and arsenicals have been found lacking. Salicylates exert their analgesic effect but do not alter the course of the disease. Fever therapy, physiotherapy, and vaccines have shown no specific effect. Thus, until specific therapy is known, symptomatic and supportive measures should be used, keeping the patient in the best state of health, nutrition, and comfort that is possible.

COURSE

The course of this disease is variable. In its mild form with little extension of the disease from its primary urethritis, conjunctivitis, and arthritis, it may run a short course with apparent recovery. However, in the severe and complicated case, and one with progressive arthritis, it may remain active for many months. Generally, after onset, the symptoms and signs increase in severity for the first month, and then gradually recede, the urologic and eye manifestations are the first to leave. Skin and mucous membrane lesions, if present, are gone before the disease has completed its course. The arthritis which initially presents itself as a polyarthritis, settles into one or two joints and may leave them chronically inflamed for months. In all reported studies the chronicity of this disease and its tendency to recur are emphasized, and once it has been recognized, these factors should be kept in mind months and years after the original episode.

CASE REPORT

C. H., a 20-year-old, white male was admitted aboard the hospital ship, U. S. S. *Repose*, in China, 26 August 1946. His chief complaints were a penile discharge, painful and swollen joints, and redness and discharge of the eyes. About 8 days prior to admission he was struck on the end of the penis by a baseball but did not note any external signs of injury. On the following day he had a yellow, purulent urethral discharge which showed gram-positive organisms on smear, and he was placed on sulfadiazine four times daily. After 1 day of this therapy his burning sensation cleared but the discharge persisted. He then noted the appearance of many small papular lesions on the glans and skin of his penis which became vesicular and ruptured, leaving small ulcerated areas which gradually became confluent. Five days before admission there was onset of pain, redness, and swelling of his left wrist which slowly improved, but on the day prior to admission his left ankle became similarly involved. About 3 days prior

to admission he awoke in the morning with a purulent conjunctivitis. Sulfonamide therapy was discontinued on the day before hospitalization. Patient was exposed sexually 6 weeks prior to onset of present illness but did not note any ill effects.

Physical examination revealed a temperature of 99.8° F. He was a well-developed and well-nourished white male, complained of pain in left wrist and ankle. A moderate conjunctivitis with purulent discharge was present. On the skin of the penis and glans there were numerous, superficial, fresh, confluent ulcerations covered with a small amount of clear, serous material. A moderate, grayish, urethral discharge was present. His left wrist was swollen, warm, and painful to palpation and full motion. The left ankle was markedly swollen, red, warm, and painful, with limited motion and pitting edema of surrounding soft tissues. Rectal examination revealed an enlarged prostate which was tender to palpation. No other physical findings were elicited.

Laboratory studies showed a normal blood picture and urinalysis. Tuberculin and Frei skin tests and blood Kahn were negative. Repeated smears and cultures of the urethral discharge, smears and cultures of prostatic fluid and fluid from the left ankle joint, smears from the penile lesions for Ducrey's bacillus, and dark field examination were all negative. Bleeding and clotting times were normal. Sedimentation rate on two occasions showed an elevation to 27 mm. per hour and 30 mm. per hour, Cutler method. Roentgenographic examination of the chest was negative and an electrocardiogram showed a normal tracing. A roentgenogram of the left ankle showed a small effusion into the joint and swelling of surrounding tissues.

Immediately, on admission, the patient was placed on a symptomatic regime. Salicylates were administered for the joint pains, boric acid solution for eye wash, and saline soaks for the penile lesions. The record of his temperature showed a low febrile course with a daily rise to the vicinity of 100° F. He obtained symptomatic relief from the salicylates although all the external signs of an inflammatory process of the left ankle joint remained constant while his left wrist was involved intermittently. His conjunctivitis disappeared 4 days after admission, the urethritis receded gradually and was absent in 10 days, and all penile lesions dried completely in 12 days of hospitalization. In view of the protracted course of this disease and its resulting, prolonged disability, the patient was evacuated on 10 September 1946, 16 days after admission.

SUMMARY

The clinical features of Reiter's disease are reviewed and a case presented. This case is reported to add to the limited literature concerning this disease, and to arouse further awareness of its existence and occurrence, and further study of the unsolved features that it presents.

REFERENCES

1. REITER, H.: Über eine bisher unerkannte Spirochaetinfektion (Spirochaetosis arthritica). *Deutsche med. Wchnschr.* 42: 1288, Oct. 19, 1916.
2. BAUER, W., and ENGLEMAN, E. P.: Syndrome of unknown etiology characterized by urethritis, conjunctivitis, and arthritis (so-called Reiter's disease). *Tr. A. Am. Physicians* 57: 307-313, 1942.
3. VALLEE, B. L.: Reiter's disease; review of literature, with presentation of case. *Arch. Int. Med.* 77: 295-306, Mar. 1946.

4. COLBY, F. H.: Renal complications of Reiter's disease. *J. Urol.* 52: 415-419, Nov. 1944.
5. TWISS, J. R., and DOUGLAS, A. H. R.: Reiter's disease; report of two cases. *Ann. Int. Med.* 24: 1043-1051, June 1946.



TRAUMATIC RUPTURE OF THE MESENTERY OF A MECKEL'S DIVERTICULUM

Report of a Case

EDWARD S. LOWE
Captain (MC) U. S. N.

Because of the unusualness of traumatic rupture of the mesentery of a Meckel's diverticulum with hematoperitoneum, such a case is hereby reported for inclusion in the surgical literature. Paucity of literature bearing on such specific traumatic lesion is evidenced by the writer's inability to find any mention of such a condition in the standard systems of surgery—Dean Lewis, Nelson, Bickman, and Horsley and Bigger; in the surgery textbooks of DeCosta and Christopher; or in such books as Moritz's "Pathology of Trauma," Boyd's "Operative Surgery." Search of the "Index Catalogue of the Library of the Surgeon General's Office, U. S. Army," third series 1926 and fourth series 1943; the "Quarterly Cumulative Index Medicus," 1943-45 inclusive; and of the "Current List of Medical Literature (Army Medical Library)" for 1946 fails to reveal listed any title in the English language bearing on this specific injury.

CASE REPORT

S. J. D., a white American male, age 32 years, was admitted to the U. S. Naval Hospital, Alea Heights, T. H., as a surgical emergency on 23 February 1947, complaining of abdominal pain of 4 hours' duration. He stated that he apparently was perfectly well until about 4 hours before admission at which time a friend who weighed 147 pounds unexpectedly sat upon his relaxed abdomen. He immediately experienced a sensation of something "breaking" in his abdomen. Pain described as dull in character became evident in the right lower abdominal quadrant. As the patient experienced a desire to defecate, he walked upstairs to the bathroom unaided. The feces and urine appeared normal to him. The pain persisted, so he went to bed. Upon reclining, he noted that the pain was becoming more cramping in character, although it was still dull, and that it was beginning to involve the left lower abdominal quadrant as well as the right lower quadrant. An ice bag applied to the abdomen perhaps afforded mild temporary relief of pain. In the course of the next 2½ hours the pain became more intense and progressively more extensively distributed until finally it involved the entire abdomen, but was maximal in intensity in the right lower quadrant. At no time was there a sharp,

particularly severe or lancinating pain, nor was there faintness or fainting. Because of the extent and severity of the pain 3 hours after injury and because of the fact that for the first time since injury he felt nauseated and vomited once, the patient decided to seek medical attention. The vomitus consisted of normal previously ingested food and drink, and contained no blood.

His past history was significant in that for a period of about 4 years, 17 years ago, he had numerous attacks of right lower abdominal pain of varying degrees of severity which attacks were diagnosed as "chronic appendicitis." Treatment of these attacks was limited to the application of cold to the abdomen. Fifteen years ago the patient had an attack of abdominal pain generalized in distribution initially and which later localized into the lower right abdominal quadrant and which was attended by nausea and vomiting. This lasted only 5 or 6 hours and the patient did not seek medical attention for it. Since then the patient has had no abdominal or gastro-intestinal difficulties until the present episode.

Physical examination upon admission revealed a well-nourished, well-developed man of the athletic body habitus who was obviously in distress because of abdominal pain, and who was in shock. Oral temperature was 98° F., pulse 86 beats per minute, and respiration 18 a minute. The blood pressure was 90 mm. of mercury systolic and 68 diastolic. There was an odor of alcohol on the breath. No pallor, cold perspiration, or air hunger was evident. The patient was mildly restless. The other significant findings were limited to the abdomen which was rigid throughout, but not "boardlike" in quality. Subjectively the point of maximal tenderness was located 5 cm. to the right of the umbilicus. Palpation of the abdomen caused accentuation of the pain throughout the abdomen and maximally to the right of the umbilicus. Rebound phenomenon was present. No masses were palpable nor was shifting dullness demonstrated. Peristalsis was active. Rectal examination revealed only tenderness on palpation on the right.

The white blood count on admission was 19,500 with a differential count consisting of 66 percent segmented cells, 1 percent band forms, and 33 percent lymphocytes. Urinalysis disclosed a specific gravity of 1.020, acid reaction, 3 to 5 leukocytes per high dry field, no red blood cells, and no sugar or albumen. X-ray examination of the chest and diaphragm was negative for pulmonary pathology and revealed no free gas under the diaphragm. A repeat white blood count made 1 hour after admission while the patient was being prepared for surgery gave a total of 22,450 cells and a differential count made up of 87 percent segmented cells, 2 percent band forms, and 11 percent lymphocytes. At this time the patient was beginning to complain of difficulty in breathing and of pain referred to his right shoulder. His pulse rate was climbing, and he was becoming more restless and apprehensive. The pain in the abdomen was generalized in distribution and had become maximal in the upper right quadrant.

Approximately 6½ hours after injury and 2½ hours after admission to the hospital, when the patient had responded somewhat to the antishock measures which had been instituted, he was taken to operation under a provisional diagnosis of "ruptured viscus." The abdominal cavity was entered through a upper right rectus incision. A large amount of free blood was encountered in the peritoneal cavity. Exploration which was carried on as the blood was being aspirated revealed a Meckel's diverticulum which was 9 cm. long and 2 cm. in diameter with a well developed distinct mesentery. In this mesentery was a hematoma about 3 cm. in diameter and leading into the hematoma was an opening about 1 cm. in diameter from which blood flowed. In palpating the hematoma, several blood clots were expressed. The mesentery of the diverticulum was clamped in the direction of its long axis which was at right angles to the mesentery of the ileum, thereby

controlling the bleeding. The mesentery of the diverticulum was divided, freeing the diverticulum up to its take off from the antimesenteric border of the ileum. The bleeding points were ligated with No. 40 cotton ties, and the raw cut edge of the diverticular mesentery was closed with interrupted suture of No. 40 cotton in such a manner as to leave a peritonealized surface. The diverticulum was excised by means of double elliptical longitudinal incisions around its base. The opening in the ileum was closed in two layers in a direction transverse to the long axis of the bowel. Blood and blood clots in an amount estimated to be 1,000 cc. were removed from the peritoneal cavity and pelvis. Upon determining that there was no further intra-abdominal trauma, that the bleeding was controlled, the suture lines intact, the lumen of the ileum at the site of removal of the diverticulum was adequate, and that the blood supply of the ileum was not compromised, the

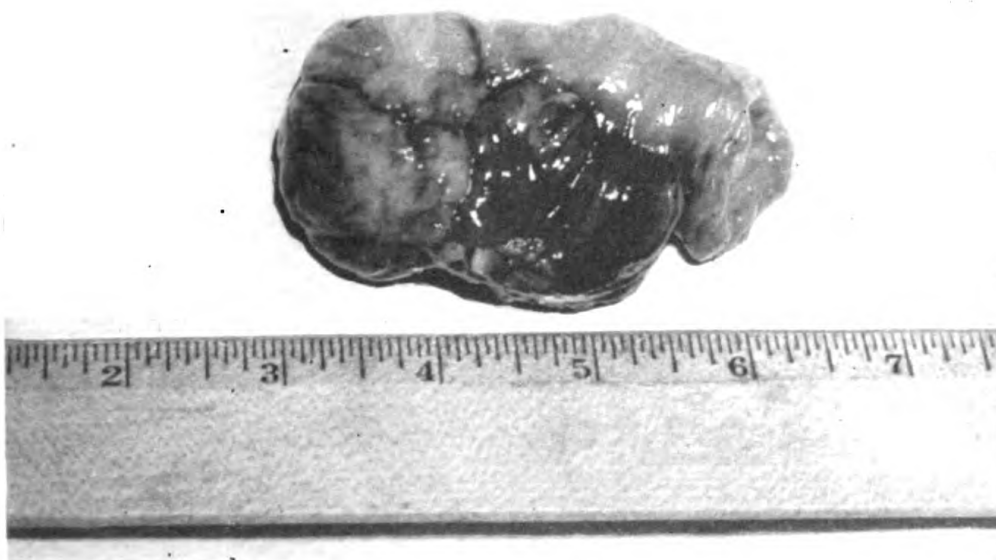


Figure 1.—Meckel's diverticulum with mesentery. The diverticulum lies superiorly with the base to the right. The mesentery lines inferiorly. The right half of the mesentery is infiltrated and distended by hemorrhage. (Inch ruler.)

abdominal wall was closed in layers with interrupted cotton sutures without drainage. Despite the past history suggestive of appendicitis, it was felt that appendectomy at this operation would not be good surgical judgment; hence the appendix was not disturbed.

PATHOLOGICAL REPORT

"Gross examination: Specimen consists of a tubular structure resembling small bowel, blind at one end. Attached to one side running to the end is a fatty structure resembling mesentery. The entire mass is covered with peritoneum except at the lines of excision. The tube is 2.5 cm. in diameter and 9 cm. long and is curved near the end, the mesenteric attachment being on the concave side. The mesentery is 3 cm. thick being distended by a hematoma within it. On both sides, the peritoneum of the mesentery is torn in several places, blood clot being present in the rents. The wall of the diverticulum is intact, though on its mesenteric side

It is infiltrated with blood. The mucosa resembles that of the small bowel. The lumen contains soft feces. There are no ulcerations or constrictions.

"Microscopic examination: There is extensive hemorrhage into the mesentery. One section shows a large vein whose wall is infiltrated with blood and polymorphonuclear leukocytes. The mucosa of the diverticulum contains both small intestinal and gastric types of glands, both chief and parietal cells being present in the latter.

"Diagnosis: Laceration and contusion of mesentery of Meckel's diverticulum."

(S) R. H. FULLER,

"Lieutenant Commander (MC) U. S. N."

SUMMARY AND CONCLUSIONS

Recorded herein is a clinical case together with operative and pathological findings which is unique in surgical literature—a case of traumatic rupture of the mesentery of a Meckel's diverticulum.



BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

SEXUAL BEHAVIOR IN THE HUMAN MALE, by Alfred C. Kinsey, Wardell B. Pomeroy, and Clyde E. Martin. 804 pages; numerous charts and tables. W. B. Saunders Co., Philadelphia and London, 1948. Price \$6.50.

Dr. Kinsey, who is Professor of Zoology at Indiana University, has directed surveys by members of the staff of the university to collect a great amount of statistical information on sexual habits. The study was carried on with money from the Rockefeller Foundation obtained through the National Research Council. Further work is being done and additional publications are contemplated. The need for such a book as this is great as there is a dearth of scientific knowledge on sex habits, as distinguished from the mass of sex tradition and taboos that too often passes for biologic truth.

As is to be expected, the facts brought out by Dr. Kinsey and his associates are at variance with the usual beliefs and social mores. Among a few of the results are the great extent of the sexual life in infancy and childhood; the fact that the sexual habits and patterns of behavior are permanently established by the age of 16; the wide variation existing in the individual; and the effects of social position on sexual viewpoints. Another interesting finding is the evidence that prostitution is of relatively minor importance. In view of the great amount of time and money spent in the prevention of prostitution one is surprised to find that it is comparatively an insignificant source of sexual activity. Incidentally, the analysis of the causes of prostitution is an excellent specimen of clear, logical English. The book also contains almost the only scientific study of sublimation this reviewer has ever seen in print.

Physicians, educators, lawyers and judges, clergymen and social workers of all sorts should read this work with great attention.

ROENTGEN INTERPRETATION, by George W. Holmes, M. D., *Board of Consultation, Massachusetts General Hospital and Clinical Professor of Roentgenology, Emeritus, Harvard Medical School* and Laurence L. Robbins, M. D., *Radiologist-in-chief to the Massachusetts General Hospital and Associate in Radiology, Harvard Medical School*. 7th edition. 398 pages; 266 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1947. Price \$7.

This is the seventh edition of a work which made its initial appearance in 1919. Such a record testifies more eloquently than words to the fundamental value of the volume.

The scope is a complete general survey of diagnostic roentgenology in clear brief fashion, and provided with adequate and improved illustrations. It should be useful in particular to the general practitioner and serve well as an introductory account for those embarking on a career in the specialty of radiology. It is not a detailed encyclopedic work of reference.

The book is of particular merit in the matter of emphasis on fundamentals. Thus there is an exposition of basic rules, a chapter on confusing shadows and artifacts and another one on anatomical variation of development. These features are of great value. It concludes with a chapter on fluoroscopic techniques. Sound advice is given here although it is felt quantitative data could be amplified to advantage. In view of a great propensity to forget or disregard safety limits, the heaviest emphasis is advisable.

Summing up, one can say that the book is well written, sound, easy to read, and entertaining. Thus one can expect, as well as hope for, a continued long life for this veteran of many years.

SURGICAL PATHOLOGY, by William Boyd, M. D., *M. R. C. P. Edin., F. R. C. P. Lond., LL. D. Sask., M. D. Oslo, F. R. S. C., Professor of Pathology, The University of Toronto*. 6th edition. 858 pages; 530 illustrations including 22 color figures. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$10.

This is the sixth revision of Dr. Boyd's most authoritative textbook, which appeared in its first edition 22 years ago. This last edition is written in the same inimitable style that has characterized all the earlier editions of this book, and which has tended to popularize it as a text in the field of surgical pathology. It is readable, fluently written, and sprinkled with the usual amount of Dr. Boyd's unique and characteristic wit.

The book is comprehensive and has been thoroughly brought up to date. There is no departure from the general organization of the previous editions. One of the new sections deals with the pathological physiology and surgical treatment of certain congenital heart diseases into the domain of which surgery has recently been introduced. Other new material includes Bittner's milk factor in relation to carcinoma of the breast, tumors of the larynx, pinealoma, avitaminosis in cancer of

the mouth, the Papanicolaou vaginal smear method in the diagnosis of carcinoma of the cervix, fibrous dysplasia of bone, inflammatory nodules of muscle in chronic arthritis and fibrositis of the back.

As a standard text on the subject this book is highly recommended and should find a place in all medical libraries.

PHARMACEUTICAL LABORATORY MANUAL, by R. A. Kuever, *Ph. G., Ph. C., Dean of the College of Pharmacy, Professor of Pharmacy, Director of the Pharmaceutical Laboratories, State University of Iowa*. 290 pages; no illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$2.75.

This book, containing 140 selected pharmaceutical operations, is a convenient combination manual and notebook in one volume. Frankly written for the student of pharmacy, it describes step-by-step instructions for the compounding of a wide range of pharmaceuticals. A valuable feature is the provision of adequate space for the jotting down of notes alongside each experiment on the physical phenomena noted during the operations. As a personally written reference it could be invaluable for the graduate in manufacturing and prescription pharmacy. Its use in many pharmacy schools and classes is recommended, and it could readily be used by any ambitious hospital corpsman interested in having the rudiments of pharmacy, if he has a basic general chemistry knowledge.

DIAGNOSIS AND TREATMENT OF PULMONARY TUBERCULOSIS, by Moses J. Stone, M. D., and Paul Dufault, M. D. 325 pages; 93 illustrations; Lea & Febiger, Philadelphia, Pa., publishers, 1946. Price \$3.50.

The tremendous field of pulmonary tuberculosis in all of its aspects is covered in only 325 small pages. From necessity, only the fundamentals of tuberculosis, without details or discussion of controversial points, have been included. The diagnostic methods and their relative importance are discussed. The greater value of roentgenology as compared to physical examination for the discovery of early tuberculosis is stressed. The chapter dealing with differential diagnosis is particularly valuable for its listing of the many conditions to be considered when pulmonary pathology is found. The chapters on treatment omit many of the newer concepts of therapy and other methods, about which there is much controversy, are presented as accepted fact. The book is of definite value as an introduction to tuberculosis for medical students, nurses, and corpsmen and for physicians who wish to review the subject in brief, concise form.

UTEROTUBAL INSUFFLATION, A Clinical Diagnostic Method of Determining the Tubal Factor in Sterility Including Therapeutic Aspects and Comparative Notes on Hysterosalpingography, by I. C. Rubin, M. D., *F. A. C. S., Clinical Professor of Gynecology, College of Physicians and Surgeons, Columbia University*. 453 pages; 159 illustrations including 4 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$10.

This is a compilation of data, illustrations from personal material, results of experiments, and conclusions gathered over a period of more than 25 years by the author.

The author has divided the book into five parts. The first four parts make up the body of the book and are divided into some 13 chapters. These four parts cover "Anatomy, Pathology, and Physiology of the Fallopian Tubes," "Technique of Tubal Insufflation Diagnosis," "Therapy," and "Comparison of Kymographic Tubal Insufflation and Intrauterine Injection of Lipiodol and Other Iodized Oils." Part 5 is devoted to the appendix, which is a very valuable part of this book.

The references are very complete and fill some 24 pages.

The illustrations are drawn from material in the author's own experience for the most part. These aid greatly in following the text.

SURGICAL DISORDERS OF THE CHEST, by J. K. Donaldson, B. S., M. D., F. A. C. S. (Lt. Col., A. U. S.), *Diplomate American Board of Surgery; Associate Professor of Surgery and in Charge of Thoracic Surgery, University of Arkansas School of Medicine*. Second edition, thoroughly revised. 485 pages; 146 illustrations and 2 color plates. Lea & Febiger, publishers, Philadelphia, Pa., 1947. Price \$8.50.

The second edition of this most important book is a modern volume published concerning surgical disorders of the chest. Its revision is timely in that thoracic surgery is today one of the most rapidly advancing fields of surgery.

The additional 120 pages include consideration of many of the basic advances made in chest surgery during World War II. Twenty-two new illustrations enhance various chapters and an appropriate bibliography affords a worth while addenda to each chapter.

The subject is divided into three parts. The first includes consideration of the thoracic wall and its involvement by infections, tumors, and injuries. A short chapter of the physiology of thoracic injuries is included. Part II discusses nontuberculous intrathoracic infections, tumors, and congenital anomalies. Pleurisy, bronchography, and the topics of pulmonary embolism and infarction are discussed. The last part of the book deals with the surgical treatment of pulmonary tuberculosis. Pertinent chapters on postoperative pulmonary complications, antibiotic therapy, anesthesia, and inhalation therapy complete this part.

The material is well arranged and comprehensive in its organization. Detailed technique of various surgical procedures have been presented by the author to afford assistance to the younger thoracic surgeon and also to be of value to the general surgeon and practitioner who are interested in evaluating such operations on behalf of their patients.

The clinical pathology and diagnosis and their correlation with treatment afford the interested physician a wealth of informative ma-

terial that is not available in any single volume today. It is highly recommended as a worth while addition to the library of those physicians who are interested in modern thoracic surgical problems and their treatment.

RYPINS' MEDICAL LICENSURE EXAMINATIONS, Prepared under the editorial direction of W. L. Bierring, M. D., with the collaboration of a review panel. 6th edition. 690 pages. J. P. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$6.

This is a new and up-to-date revision of the standard compend for those about to take examinations of various kinds. There is a new section on neuropsychiatry. Eleven excellent medical men on the panel in addition to Dr. Bierring assure the authoritative character of the answers. A short section on medical history would be of value and is suggested by this reviewer that this be included in the next edition.

ELEMENTARY MEDICAL PHYSICS, by Howard O. Stearns, *Associate Professor of Physics, Simmons College*. 354 pages; numerous illustrations. The Macmillan Co., New York and London, publisher, 1947. Price \$4.75.

This is an excellent elementary text on physics. The mathematical features are not too involved and at the end of each chapter is a list of study questions and a number of problems. The illustrations are excellent and include a number of medical instruments and appliances to illustrate the application of physical principles to them. The sections on x-rays, radium, nuclear structure, isotopes, and atomic fission are simple and clear, and aimed at the beginner in knowledge of these subjects.

EMOTIONAL MATURITY, by Leon J. Saul, M. A., M. D., *Associate Professor of Psychiatry, Temple School of Medicine*. 338 pages. J. P. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$5.

The subtitle of this work is "The Development and Dynamics of Personality." The writer evidently has a lay reading public in mind. There is a large amount of useful information, though one cannot but question some statements, notably one printed on the cover jacket that there are no problem children, only problem environments and parents.

OBSTETRICS AND GYNAECOLOGY, by C. Scott Russell, M. A., M. B., F. R. C. S. (Edin.), M. R. C. O. G., *Assistant Director, Department of Obstetrics and Gynaecology, University of Manchester*. 214 pages; illustrated. Oxford University Press, London, 1947. Price \$4.25.

This is a survey course to bring practitioners up to date on late developments and also to refresh the mind on fundamentals.

PUBLIC HEALTH ADMINISTRATION IN THE UNITED STATES, by Wilson G. Smillie, M. D., *Professor of Public Health and Preventive Medicine, Cornell Medical College*. 637 pages; illustrated. 3d edition. The Macmillan Co., New York, 1947. Price \$6.50.

This is a good single volume by a single author, well written and containing the most modern concepts of public health problems. It is a valuable book for a health officer or for the practicing physician. There is an impartial presentation of the new ideas of the extension of public health from disease prevention to include also medical care. The section on mental hygiene also is free from nebulous ideas. The section on nutrition frankly discusses many of the extravagant claims and ideas in regard to this much-abused subject. To mention just one, Dr. Smillie, on page 362, shows how unreliable a physician rating of nutrition can be when based on a single examination. Even when done by skilled pediatricians, as in the instance cited, the results were almost completely unreliable.

HANDBOOK OF PSYCHIATRY, by Winfred Overholser, A. B., M. D., Sc. D., *Superintendent of St. Elizabeths Hospital; Professor of Psychiatry, George Washington University*, and Winifred V. Richmond, *Late Chief, Department of Psychology, St. Elizabeths Hospital*. 252 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$4.

This is a brief compend of mental diseases written so that it can be read by the intelligent layman and yet valuable as a review of psychiatry for the physician. The opinions expressed are not radical or extreme, and at times the true philosophic viewpoint is achieved.

AN INTRODUCTION TO SOCIOLOGY AND SOCIAL PROBLEMS, a Textbook for Nurses, by Deborah MacLurg Jensen, R. N., B. S., M. A., *Assistant Director, School of Nursing, St. Louis City Hospital*. 3d edition. 476 pages. Illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$3.75.

Written with considerable verve and illustrated principally with charts and pictographs. The book, however, contains a great number of categorical statements in regard to highly controversial subjects that detracts from its usefulness as a text.

THE ESSENTIALS OF OBSTETRICS AND GYNECOLOGY, by William Albert Scott, B. A., M. B., F. R. C. S. (Can.), *Professor of Obstetrics and Gynecology*, and H. Brookfield Van Wyck B. A., M. B., F. R. C. S. (Can.), *Assistant Professor of Obstetrics and Gynecology, University of Toronto*. 390 pages; 126 illustrations; 13 in colors. Lea & Febiger, Philadelphia, Pa., publishers, 1946. Price \$5.50.

Carefully prepared condensation of the subject intended particularly for undergraduates. A study for the beginner with the details eliminated so that after the essentials are fixed in the mind the use of larger textbooks and the results of experience can be better integrated into the student's knowledge.

CANCER, Diagnosis, Treatment, and Prognosis, by Lauren V. Ackerman, M. D., *Assistant Professor of Pathology, Washington University School of Medicine* and Juan A. del Regato, M. D., *Radiotherapist to the Ellis Fischel State Cancer Hospital*. 1,115 pages, 745 text illustrations; and 42 color illustrations. C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$20.

This is a general and comprehensive survey of the whole subject of cancer from a clinical viewpoint. Research on etiology is given little space but each anatomic system is covered for all sorts of malignant and benign growths. As a guide to the clinician whether specialist or general practitioner, it will be a most useful work.



PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



THE SPREAD OF INFLUENZA A AND OTHER ACUTE RESPIRATORY DISEASES IN A UNITED STATES NAVAL TRAINING CENTER

JAMES R. KINGSTON ¹
Commander (MC) U. S. N.

ELMA T. JARRETT ²
Lieutenant (HC) U. S. N.

O. C. DIERKHISING ¹
Chief Hospital Corpsman, U. S. N.

and

W. H. WELLS ²
Chief Hospital Corpsman, U. S. N.

The occurrence of influenza of epidemic proportions in many regions during the winter or early spring of 1947 was no surprise to many students of the epidemiology and periodicity of this disease. The Commission on Acute Respiratory Diseases, Fort Bragg, N. C., in their excellent study of the cyclical pattern and periodicity of influenza (1), pointed to the fact that in the past 25 years, 7 of the 11 epidemics of presumptive influenza A have recurred at an interval of 2 years and the remaining 4 with a 3-year interval. On the basis of this study it was considered likely that influenza A would reappear during the winter of 1945-46, and further, "If it fails to occur in this season, the probability is much greater that it will appear in the following winter," (1947).

As far as is known to the authors, with the exception of sporadic cases and local outbreaks in restricted populations, no widespread prevalence of influenza A was experienced during the season of 1945-46. Numerous tests conducted during the winter-spring months of 1946, on representative samples of naval recruits from the mid-Western States detected no evidence of antibody response to virus A as indicated by the Hirst erythrocyte agglutination-inhibition test

¹ Epidemiology Unit No. 13.

² Ultraviolet Research Unit, Medical Department, U. S. Naval Training Center, Great Lakes, Ill.

(2) (3). Therefore it was considered likely that, if isolated outbreaks occurred in the mid-Western States, and of less import, in the Southern and Eastern States, in 1947, influenza would be introduced in this training center by the large number of recruits, service school students, and other personnel entering the center from these areas; as new recruits, from furloughs, or by routine change of duty station.

Local environmental factors.—The general sanitary standard of naval service schools and recruit training units has greatly improved since the period during and immediately following World War II. There is less crowding of individuals in barracks and more attention to fundamental hygienic and sanitary practices. However, ample opportunity still exists for rapid dissemination of disease agents from one group to another—in the classrooms, the recreation rooms, movies, etc., where general intermixing of persons occur, accompanied by continuous exchange of organisms harbored in the respiratory apparatus of “carriers” and subclinical cases. The age group of a training center provides one of the basic elements, the presence of sufficient numbers of susceptibles, for many communicable diseases. Approximately 15 percent of the station’s population were new recruits billeted in a semi-isolated camp. The service schools consisted of seamen with 3 or more months’ naval service, and accounted for 65 percent of the population. The remaining 20 percent consisted of mature, well-seasoned men in permanent duty status. Fully 85 percent of the population was under 20 years of age.

METHODS OF STUDY

Nose and throat cultures were taken for hemolytic streptococci on all admissions to the sick bay for respiratory infections. Streptococci were grouped and typed by the Lancefield method. This work was in conjunction with the streptococcus control program and the ultraviolet irradiation study. Daily population data and records of admissions to the dispensary for upper respiratory diseases were maintained.

The Hirst agglutination-inhibition test for antibody response to influenza virus A and B was carried out during and following an outbreak of this disease. For the purpose of establishing the etiology of the outbreak two specimens of blood were collected from representative samples of patients admitted to the sick list. The first sample of blood was taken during the first 3 days of illness and the second specimen 10 days later. Sharples concentrates (Lederle) of PR8 and Lee strains of virus A and B were used in all titrations. Taking cognizance of the variation of chicken cells, as reported by Burnet (4), titrations were carried out with the same fresh cells and virus dilutions for both acute and convalescent phase sera at the same time. Results of these observations is the subject of this report.

PREVIOUS EXPERIENCE AND RECENT OBSERVATIONS

The training center had experienced extremely high incidence rates for acute respiratory infections during the winter months of the previous 5 years. Streptococcal infections were the major cause for admissions to the dispensary and hospital for treatment in the winter of 1945-46. The carrier rate for β hemolytic streptococci among healthy recruits ranged from 40 to 55 percent, and 50 percent of new recruits were admitted to the sick list with acute respiratory infections within 6 weeks after their arrival in the training center (9). Diseases of viral etiology were distinctly secondary in the over-all morbidity of communicable diseases. The most striking change in the usual trend of respiratory disease during the late autumn to midwinter of 1946-47 was the remarkably low incidence with few streptococcal infections compared to the experience of previous years. Scarlet fever was conspicuously absent from the recruit unit during the 3 winter months. The carrier rate for group A hemolytic streptococci among healthy recruits remained low, less than 10 percent of the expected level based on previous years.

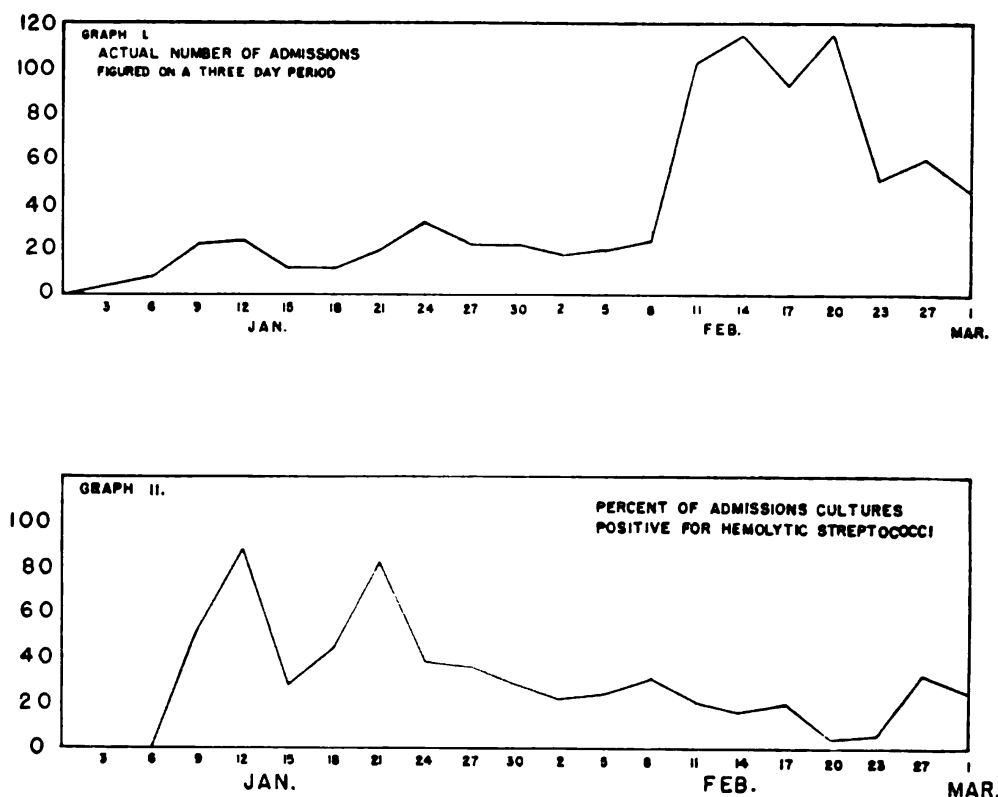


Figure 1.—Factor of hemolytic streptococci in respiratory disease.

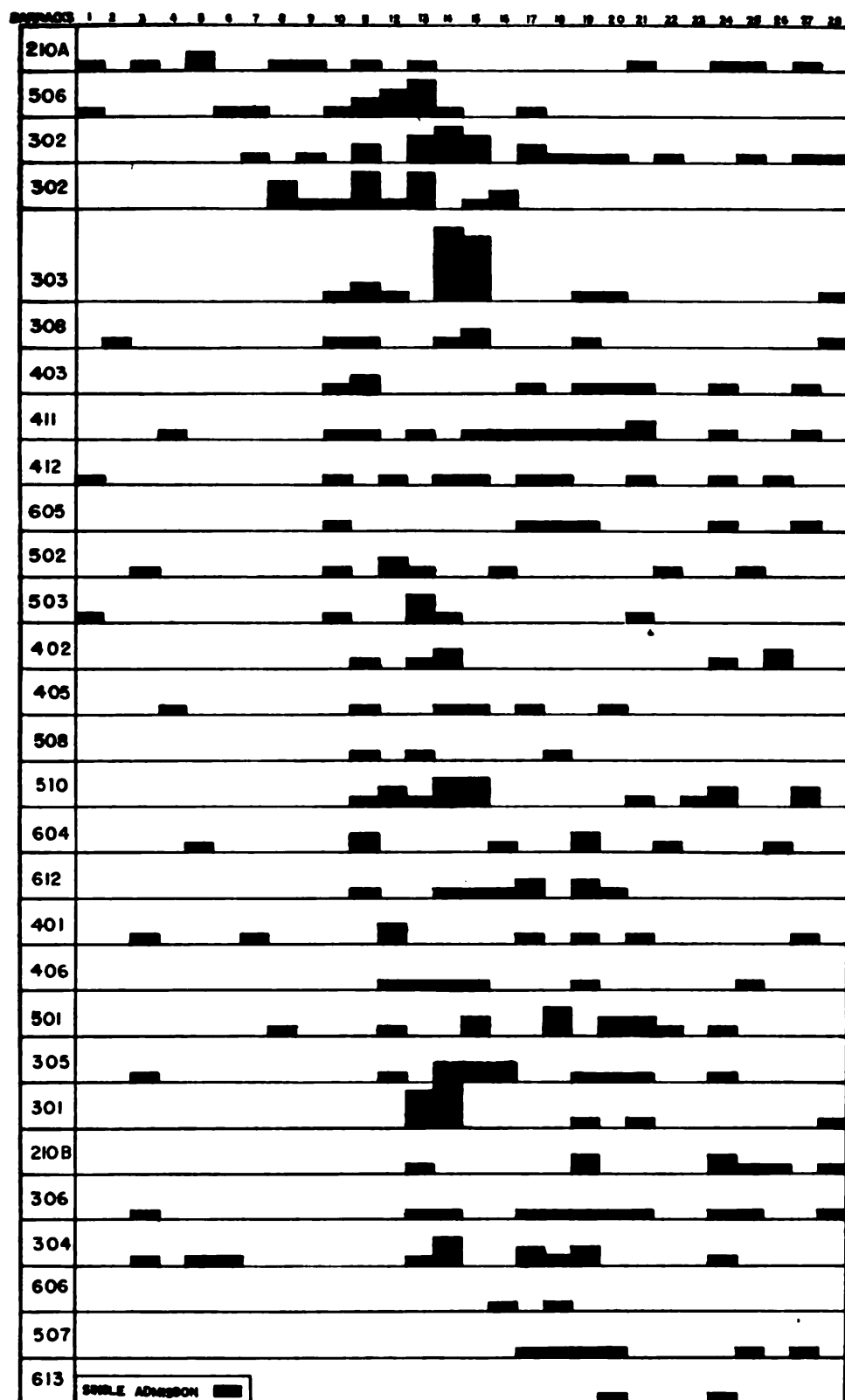


Figure 2.—Spread of respiratory infections in barracks during February 1947.

A reasonable amount of respiratory disease, as was expected, carried on through the winter months. Hemolytic streptococci, played a definite part in the infections occurring in the service school area. Figure 1, graph I, shows the actual admissions in January and February, and figure 1, graph II, the percentage of the admissions showing positive cultures for group A hemolytic streptococci.

The cases of respiratory disease were scattered throughout the station generally, and review of admissions prior to February showed that there was no particular concentration of infection in any barracks.

EPIDEMIC

During the first week of February a sharp increase in upper respiratory infection occurred in barrack 210-A, a receiving and outgoing unit. On 6 February barrack 506 presented an increased number of infections, followed by outbreaks in two other barracks on 7 and 8 February. On 10 February the outbreak had spread to 8 additional barracks, and thence from one barrack to another until 28 barracks were affected by 17 February. It was noted that, once a barrack was affected, most of the admissions to sick bay occurred within 10 days. Figure 2 indicates the progressive spread from one barrack to another in the service school area.

CLINICAL AND SEROLOGICAL OBSERVATIONS

The symptoms shown by these cases were relatively mild, consisting of fever of 100° to 102° F., headache, sore throat, general malaise, non-productive cough, some pains and aches in the bones and joints; gastrointestinal upsets were common. Physical findings were minimal. There was a mild redness of the throat, minimal catarrhal inflammation of the nose. The lungs were clear, although a few cases of atypical pneumonia were admitted. Symptoms were consistent with those described by Ingalls et al. (5) for an outbreak of type A influenza. The men were in sick bay less than 4 days, and returned to duty afebrile. Readmissions were at a minimum. None of the serious lung complications reported by Parker et al. (6) was seen. W. and G. Henle (7) have called attention to the toxic properties of the influenza virus, and the variation in the toxicity of various strains which they feel may play a part in severity of various epidemics. Toxic manifestations were exceedingly mild among patients in this outbreak. Complications were at a minimum.

Paired blood samples, acute and convalescent, were collected from each of 22 patients and tested for increased antibody titers, as indicated by hemagglutination-inhibition. Twenty-one of the twenty-two showed an increase of titer of virus A. Table 1 shows the distribution of titers.

TABLE 1

	1:32	1:64	1:128	1:256	1:512	1:1,024	1:2,048	1:4,096	1:8,192
"A"—PR8:									
Acute	0	3	6	6	4	3	0	0	0
Convalescent	0	0	0	1	3	5	8	3	1
"B"—Lee:									
Acute	8	5	5	4	0	0			
Convalescent	2	5	6	6	1	2			

Consideration of the epidemic into two separate parts seems justified as the recruit training group is a closed population that is received into a restricted area. There is a minimum of mixing with the general population, and liberty is at a minimum. However, the companies in recruit training mix more thoroughly among themselves and the result was an explosive epidemic. Figure 3 shows the relative incidence of influenza in both sections of the center—the recruit unit and Service Schools.

INFLUENZA A IN THE RECRUIT TRAINING UNIT

On 16 February, 10 days after the service schools experienced the initial episode, the outbreak occurred in explosive form in the recruit training unit fig. 3. One hundred forty-three cases were admitted to the dispensary in 1 week (weekly rate: 141/1000) compared to 62 cases admitted during the previous 12 weeks; the average strength of the unit had remained unchanged, the number ill had increased nearly thirty. An average of 14 percent of each company was admitted to the dispensary in 1 week. The outbreak subsided with dramatic abruptness on the eighth day, with only sporadic cases occurring from companies of recruits who had been present during the peak of 7 days. Recruit companies in the various stages of training, 1 to 12 weeks, were equally affected.

An early secondary rise in the incidence of influenza was considered as probable, following the peak in mid-February. The secondary rise

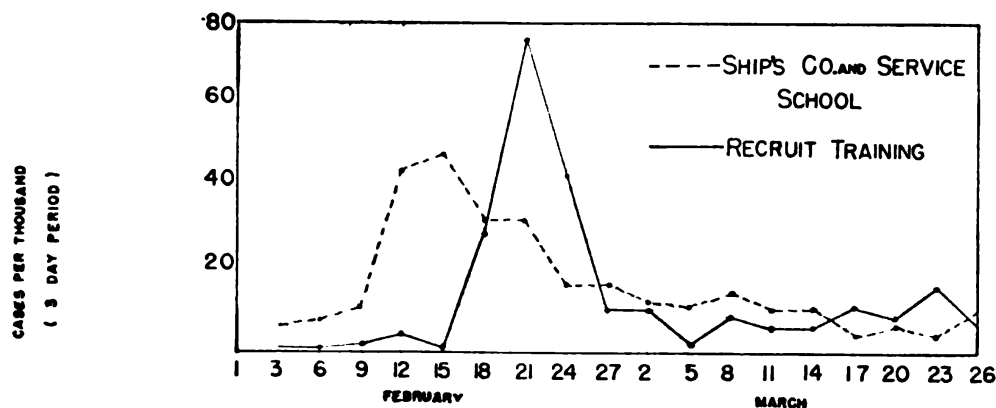


Figure 3.—Admissions for upper respiratory infections.

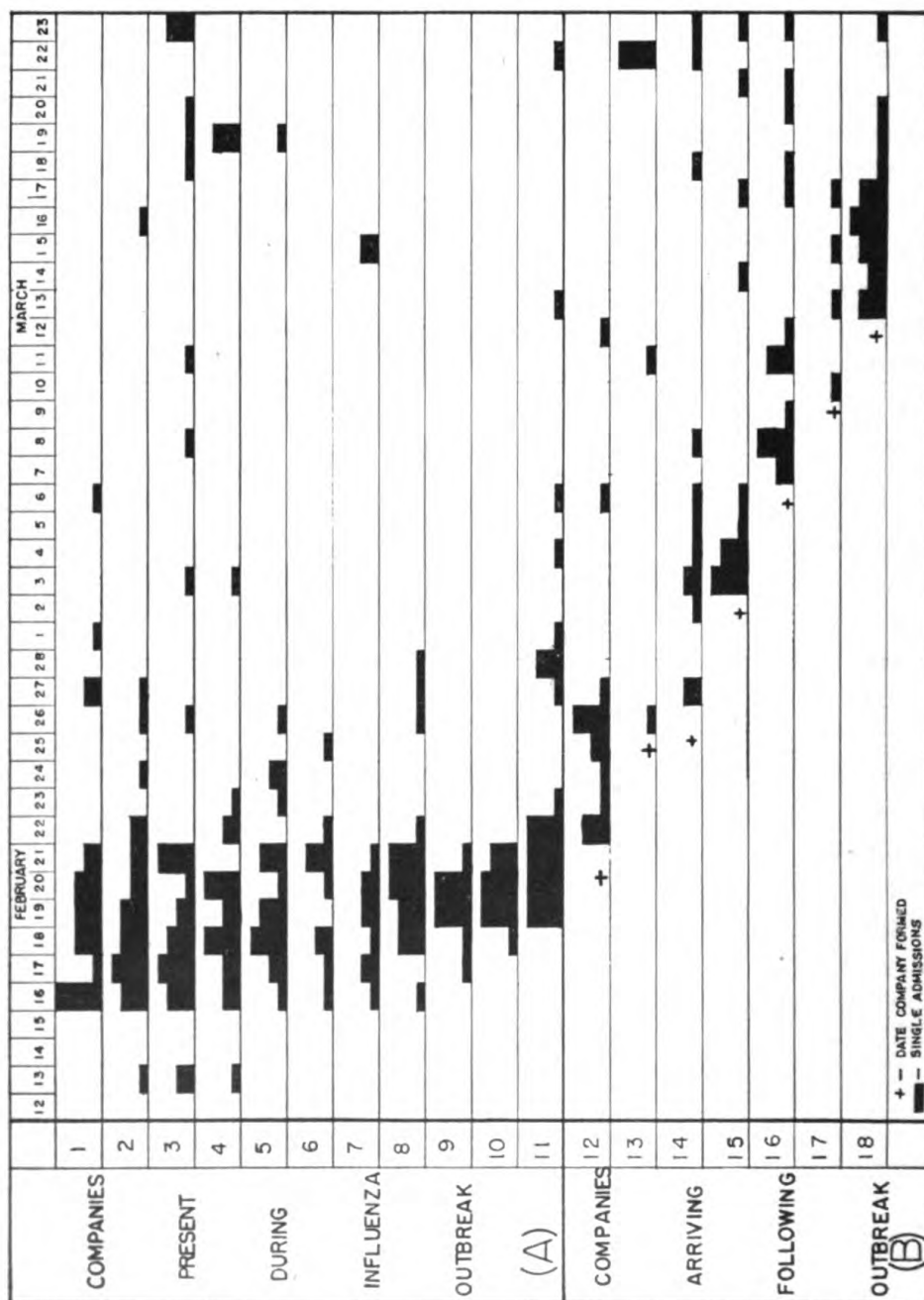


Figure 4.—Admissions for respiratory disease among recruit company units.

did not develop in significant proportions among recruit companies that were present during the outbreak (fig. 4A). However, the constant influx of new susceptibles at the rate of 250 to 300 new recruits each week created a favorable condition for maintaining residual influenza by upsetting the balance between susceptibles and immunes in the population; approximately 25 percent of the recruit population was replaced by new arrivals each week. New recruit companies of 110 men were formed every 3 to 4 days during and immediately following the epidemic. With few exceptions, these new company units experienced distinct outbreaks of acute respiratory infections, primarily influenza A, during their first week in camp (fig. 4B). Relatively minor outbreaks were observed in certain companies which were, with one exception, billeted immediately on arrival in barracks having ultraviolet irradiation. It is probable that irradiation lessened the risk to infection among these companies (8) (9). The striking similarity of influenzal behavior in new companies and units that were present during the peak of incidence is evident.

Morbidity of recruits.—A change in the morbidity by stage of training occurred following the outbreak in February. Prior to this event recruit companies showed a low incidence of acute respiratory infection during the first week of training, the peak of incidence of acute respiratory infection had occurred in the third week of training. Other observers have reported the highest morbidity for recruits as occurring in the third to fifth week of training (8) (9).

All new companies formed after mid-February (to 1 April) showed a progressive decline in morbidity after the first week of training. This sudden sharp rise in illness of new arrivals is in accord with the expected experience of new susceptibles entering an environment where influenza is prevalent. The primary cause of this condition was confirmed by demonstration of increased antibody response to virus A in representative samples of cases admitted to the sick list.

Paired acute and convalescent blood samples were taken from 7 recruits admitted to sick bay on 3 April. The table shows the results of the Hirst agglutination-inhibition tests.

TABLE 2

Case	PR8		Lee	
	Acute serum	Convalescent	Acute serum	Convalescent
1.....	16	2,048	16	64
2.....	64	1,024	32	64
3.....	64	1,024	64	128
4.....	64	256	32	32
5.....	128	1,024	64	128
6.....	128	512	64	128
7.....	128	1,024	256	256

The outbreak of influenza in new companies during their first week in camp, as noted in figure 4B, continued until 5 April 1947. It was noted that 6 new companies forming after this date did not experience any significant first-week outbreak of illness. Since influenza had been reported from numerous areas where the recruits came from, it was considered likely that a number of these new arrivals in camp had had recent experience with influenza. The virus-A hemagglutination-inhibition titer of 100 sera of men in these new companies was compared with the virus-A titer of 78 recruits on the station who were acutely ill or had no recent illness.

TABLE 3

Serum dilutions	On station	Incoming recruits
	<i>Titer "A," percent</i>	<i>Titer "A," percent</i>
1:64.....	19	19
1:128.....	29	39
1:256.....	24	23
1:512.....	19	10
1:1,024.....	8	5
1:2,048.....	1	3
1:4,096.....	0	1

These results reveal no appreciable difference between the antibody level of new arrivals and the level of acutely ill or non-affected recruits; at least not of the order that would explain the subsidence of early outbreaks in companies arriving after 1 April. However, Sugg and Magill (10) found that in ferrets height of antibody titers was not always an index of resistance to influenza.

The observation was made that there was a considerable number of upper respiratory infections that were not severe enough for the men to be admitted to sick bay. These cases were clinically indistinguishable from admissions except in degree of symptoms. Blood was taken from 10 men not admitted to sick bay from each of three different companies 2 weeks after the epidemic, and we found that they were of the same antibody level as the acute serums, and similar to levels observed by Milstone et al. (13) while studying an influenza outbreak. Table 4 indicates the titer of these cases.

TABLE 4.—Comparison of titers with PR8 strain virus A of random samples of well men with acute sera

	1:16	1:32	1:64	1:128	1:256	1:512	1:1,024	1:2,048
Company:								
2.....	0	0	3	2	3	2	.....	.....
14.....	0	0	0	4	2	2	1	1
15.....	0	0	1	1	4	3	1	.....
Acute serums.....	0	0	3	6	6	4	3	0

¹ History of illness 3 March.

Specific types of group A hemolytic streptococci among recruits.—The outbreak in the recruit training unit was accompanied by a significant change in the predominant type of streptococci. Type A-5 hemolytic streptococci was most prominent in the environment of the recruit unit prior to the epidemic. This type had accounted for 63 percent of all group A streptococci isolated from throats of healthy carriers, respiratory infections, and barracks dust and air samples during the 6 weeks prior to 16 February. Type A-5 streptococci subsided promptly with the epidemic. Type A-24 appeared among recruits during the outbreak of influenza A and accounted for 84 percent of positive streptococci cultures during the 6 weeks immediately after the outbreak.

TABLE 5.—*Prevalent types of group "A" hemolytic streptococci in recruit units 6 weeks prior to and 6 weeks following outbreak*

Types	Prior to outbreak	Following outbreak
3.....	1	0
5.....	14	1
12.....	1	0
17.....	1	0
19.....	1	1
24.....	0	16
26.....	1	2
(?).....	2	0
Total "A's".....	21	19
Negative or not "A".....	32	274

DISCUSSION

The nature of a training center of this type offers excellent opportunities for the spread of disease in a manner favorable to rapid dissemination of the etiological agent once such agent is introduced. Under these circumstances, with the widespread origin of incoming personnel, the possibility of an outbreak in the form of acute respiratory infection would appear inevitable.

The unusually low incidence of respiratory infections that prevailed prior to February appeared to set the stage, as it were, for the dramatic suddenness of the spiral curve observed among recruits. The spread of influenza A in the recruit training unit was similar to the pattern observed in the service schools and other parts of the main station except that it was more spontaneous, spreading rapidly from one company to another until all recruit units present were more or less equally affected within 8 days. Dr. Watson G. Smillie of New York has made the observation that "There is remarkable rapidity of spread of the disease (influenza) and a high degree of communicability. In this it outranks all other contagion." It was estimated that 60 percent of the recruits were affected with minor respiratory ailments, presumably

influenza. However, this estimate was not borne out by subsequent tests of antibody titers among persons who had had subclinical attacks, or who claimed to have had "colds"; 10 percent of these subclinical cases showed significant virus-A antibody titers. The greater incidence and more rapid spread of infection among recruits compared to other groups may possibly be explained by their more intimate contact and the relative immaturity of recruits in point of age, naval service, and lack of prior exposure to the seasoning process of naval service experienced by the older age group.

The attack rate of upper respiratory disease varied from one barrack to another in service school from 1 to 20 per 100, but the picture here was clouded by an underlying streptococcus and nonspecific respiratory disease which had been present for some time. Concurrently with the spread of influenza there was a development of foci of group-A hemolytic streptococcus infection in some of the barracks. Also, men in service school tend to avoid sick bay so as not to lose time in their classes. In recruit training, however, there was an attack rate during the epidemic varying from 9 to 16 percent in different companies, with an average of 14 percent, which is comparable to the rate (9.9 percent) observed by Francis, Salk, et al. among unvaccinated men in an epidemic of influenza B at the University of Michigan. Francis (12) has called attention to the fact that the attack rate is highest in persons under 15 years of age. The average age of recruits was 17 plus. Francis et al. (11) described an epidemic of influenza B, in the University of Michigan, taking 2 months for the cases to build up. Commander McFarland described an outbreak of B influenza in a naval attack transport which affected 30 percent of the personnel in 30 days. An epidemic of influenza A described by Ingalls et al. went through 680 men in a boys' school in less than 6 weeks, giving 214 patients with upper respiratory disease.

We believe that influenza-A and type A-24 streptococci were introduced to the recruits by regular station personnel, instructors, etc., and from the service schools on the mainside of the training center. As previously mentioned, the service schools experienced the February outbreak 8 to 10 days before the spontaneous occurrence among recruits. Moreover, type A-24 streptococci had been absent from the recruit training unit but had predominated in the service schools for many weeks. It seems reasonable to assume that these two agents, virus-A and type A-24 streptococci, were spread through a common channel.

According to Spear (14), epidemics of influenza which occur in late winter or spring are apt to be followed by a second wave within 6 months. If this relationship between one epidemic wave and the next

holds true, it is not unreasonable to expect a recurrence of the present epidemic in the early autumn of 1947. The extent of widespread prevalence of influenza in 1947 is not known at present (March 1947). Unconfirmed reports indicate that numerous local outbreaks have occurred throughout the country, both in military and civilian populations. A number of schools have been closed at one time or another in the mid-Western States during February and March 1947, reputedly due to influenza. Whether these outbreaks are a part of a major epidemic that may be considered as in phase with the 3-year cycle suggested for influenza A, depends somewhat on the prevalence reported from many geographical areas to complete the pattern of influenza for 1947.

REFERENCES

1. The Commission on Acute Respiratory Diseases: Periodicity of Influenza. *Am. J. Hyg.* **43**: 29-37, 1943.
2. HIRST, G. K.: Quantitative determination of influenza virus and antibodies by means of red cell agglutination. *J. Exper. Med.* **75**: 49-64, Jan. 1942.
3. PLATZER, R. F.: Epidemiology Unit No. 13, U. S. Naval Training Center, Great Lakes, Ill., 1946. (Unpublished.)
4. BURNET, F. M., and STONE, J. D.: Serological response to influenza B infections in human beings. *Australian J. Exper. Biol. & M. Sc.* **24**: 207-211, 1946.
5. INGALLS, T. H., and GALLAGHER, J. R.: Outbreak of influenza A in a boys' school. *New England J. Med.* **235**: No. 22, Nov. 1946.
6. PARKER, F.; JOLIFFE, L. S.; BARNES, M.; and FINLAND, M.: *Am. J. Path.* **32**: 797-819, July 1946.
7. HENLE, W., and HENLE, G.: *J. Exper. Med.* **84**: No. 6, Dec. 1946.
8. WHEELER, S. M.; INGRAHAM, H. S.; HOLLAENDER, A.; et al.: Ultraviolet light control of airborne infection in a naval training center. *Am. J. Pub. Health* **35**: 457-468, 1945.
9. MILLER, W. R.; JARRETT, E. T.; HOLLAENDER, A.; WILLMON, T. L.; et al.: Evaluation of ultraviolet irradiation and dust control measures in control of respiratory disease. (To be published.)
10. SUGG, J. Y.: Significance of antigenic differences among strains of influenza A virus in reinfection of ferrets. *Proc. Soc. Exper. Biol. & Med.* **63**: 1-5, Oct. 1946.
11. FRANCIS, T., Jr.; SALK, J. E.; and BRACE, W. M.: Protective effect of vaccination against epidemic influenza B. *J. A. M. A.* **131**: 275-278, May 25, 1946.
12. FRANCIS, T., Jr.: Epidemiology of influenza. *J. A. M. A.* **122**: 4-8, May 1, 1943.
13. MILESTONE, J. H.; LINDBERG, R. B.; BAYLISS, M.; and DE COURSEY, E.: 1945 influenza B epidemic in Pacific area. *Mil. Surgeon* **99**: 777-784, Dec. 1946.



AIR-BORNE PHOTOFLUOROGRAPHIC UNIT

J. M. LORÉ, JR.

Lieutenant, junior grade (MC) U. S. N. R.

Mass chest x-ray examination for the control of tuberculosis of naval and Marine Corps personnel, using the photofluorographic technique on 35 millimeter film, and utilizing both stationary and trailer-borne units, has been in commission during World War II. With the termination of hostilities in the Pacific area, personnel are now stationed for longer tours of duty on the smaller outlying islands which are accessible for the most part only by air. To chest x-ray these men periodically, using the local facilities, would tax the depleted medical and x-ray staffs beyond the margin of adequate examination. Some islands do not have x-ray technicians as such and to mass chest x-ray even several hundred patients, using the conventional 14 by 17, 6-foot film, would be quite impossible. Besides, the supply of satisfactory 14 by 17 film is so depleted that the procedure on that score alone is impossible. Added to this is the fact that most of these outlying bases in the Pacific have only portable x-ray machines, making it easy to see the difficulties of mass periodic chest x-ray examination. The necessity of adopting some type of photofluorographic technique which could be transported by air seemed the answer to the problem.

The Midway Islands lying some 1,300 miles northwest of Pearl Harbor, where the nearest photofluorographic unit is stationed, were the guinea pigs so to speak. To transport by air the complete photofluorographic unit would entail a major electrical engineering feat, not to mention the weight and space that would be consumed even on the larger naval air transport planes. Such space is precious for food and other essential supplies. The scheme was to transport only what was absolutely necessary—nothing more. By dispatch it was learned that Midway Islands had several portable x-ray machines, the maximum capacity being only 30 milliamperes. All photofluorographic units utilize 200 milliampere capacity x-ray sources. The question of exposure was the problem. Using a 200 milliampere x-ray machine the usual exposure time for the average chest is approximately $\frac{1}{10}$ to $\frac{1}{5}$ second, the pkv remaining constant at either 80 to 90 pkv. The portable x-ray machines can develop similar pkv, however not as steadily since they are usually connected to a 110- to 120-volt "house line" whose line voltage fluctuates. At any rate the only solution apparently was increasing the time of exposure. That meant giving each patient somewhere in the vicinity of $1\frac{1}{2}$ to $2\frac{1}{2}$ seconds exposure. Would most patients hold still for this length of time and would the heart action blur the lung fields? Would the small portable x-ray

machines operate within their tubes' safe capacity? Would the machines overheat?

The modern photofluorographic unit besides having a great power plant is equipped with automatic camera and phototimer to yield perfectly exposed pictures. Such equipment could not be carried by air and hooked up to a portable x-ray machine without considerable trouble necessitating an expert x-ray engineer. All that could be done was to take the photofluorographic tunnel with fluorescent screen and a hand operated Leica camera. This weighed only 75 pounds. The heaviest item which could not be dispensed with was the balancing stand and holder for the tunnel and camera. Its weight was 475 pounds.

The next difficulty in mass chest x-ray examination is the interference with the regular duties of the subjects to be examined. This meant the problem of the rapid handling of the patients using only a portable x-ray apparatus. To complicate the pictures at Midway Islands the unloading of an aircraft carrier was unfortunately delayed by foul weather just to coincide with the arrival of the photofluorographic unit. Accurate staggering of patients appeared to be the obvious solution.

The water supply on most island bases is brackish except for the distilled drinking water. To learn the lesson of using drinking water for the mixing of developer solutions required almost 24 hours of dissolving film developer in the regular tap water. The other dark-room nuisances were overheating of developer solutions which might seriously endanger the grain of the 35-millimeter film and thereby ruin the fine detail so necessary to catch the early lesions of tuberculosis. The heavy humidity added to the slow drying of the exposed and developed film.

With these obstacles in mind, the system used to accomplish rapid mass chest x-ray examination was the transportation by air of some 600 pounds of photofluorographic equipment. This included:

1. Photofluorographic tunnel, complete with stationary grid, fluorescent screen and protective lead glass.
2. Photofluorographic tunnel stand.
3. Leica camera, hand operated complete with F 1.5 lens.
4. Hangers, for 35-millimeter x-ray film.
5. Leitz 35-millimeter film viewer.
6. Numbering machines for medical history sheets.
7. X-ray film, both 35-millimeter and 14 by 17 sizes.
8. Office record equipment.
9. Photofluorographic x-ray developer.

The exact gear needed was decided upon by the response to a dispatch sent to the activity. The dispatch requested information regarding:

1. Name of manufacturer of available x-ray machine and type of model.
2. Capacity in milliamperes of available machine.
3. Is there a rating chart for tube of available x-ray machine?
4. How many men on station who have not had photofluorograms in past 12 months?
5. Darkroom facilities.

A spare x-ray tube suitable for the x-ray machine might also be taken if none is available at the outlying base.

Trial runs using the several available portable x-ray machines at Midway Islands on various sized chests aided in the establishment of a successful roentgenological technique. It was finally decided that using two of the portable x-ray machines would facilitate more rapid handling and obviate overheating of the x-ray machines. A Fischer apparatus with a capacity of 30 milliamperes was used for the 35-millimeter exposures while a Mattern Beeber apparatus with a capacity of 20 milliamperes was used for the 14 by 17 retakes of suspicious cases. When the latter apparatus was in use, the cassette with the 14 by 17 film was placed over the fluorescent screen of the photofluorographic tunnel.



Figure 1.—Using a portable x-ray apparatus to take 35-mm. photofluorograms. In the background are tables set for booster injections of tetanus and typhoid. With this arrangement, up to 75 men per hour were handled.

Tables 1 and 2 illustrate the roentgenological technique that was developed using the two above-mentioned x-ray machines.

TABLE 1.—*Photofluorographic technique for Fischer machine at a distance of 36 inches*

Chest meas. in cm.	Kilovolts	Time, minutes	Milli- amperes
19	78	1	20
20	80	1	20
21	82	1	20
22	84	1	20
23	86	1	20
24	88	1.25	20
25	90	1.25	20
26	90	1.25	20
27	90	1.50	20
28	90	1.75	20
29	90	2	20
30	90	2	25

TABLE 2.—*X-ray technique for Mattern Beeber machine¹ 14- by 17-inch films at a distance of 72 inches*

Chest meas. in cm.	Kilovolts	Time, minutes	Milli- amperes
19	No. 2	0.75	15
25	No. 2	1	15
30-35	No. 3	1.5	15

¹ This machine is unsafe to use for photofluorographic purposes if a Lysholm grid is used in front of the fluorescent screen. This observation is made due to the fact that when operating under these conditions, exposure values which are above the capacity of the machine must be used to obtain satisfactory photofluorograms.

To minimize the danger of burning out the x-ray tubes the milli-ampereage was never used to capacity, an increase in the time of exposure being used, to make up the difference of exposure. The pkv was also varied as well as the time of exposure.

An exact plan of staggering patients was arranged with the personnel officer through the cooperation of the medical officer in command and the base commander. Using the chief pharmacist's mate to operate the x-ray machine, change the numbers on the screen and turn and load the camera and using the seaman to act as receptionist, keep the log and check and number the medical history sheets, 40 chest x-rays per hour were accomplished. The developing and reading of the films were done in the evening and morning. Several rolls of film developed electrical static causing 17 technically unsatisfactory pictures. These were the only technically unsatisfactory films. When a suspicious lesion was discovered on the 35-millimeter film a retake 14 by 17 film was made the following day and the patient requested to reappear for physical examination and history taking, when the larger film confirmed the suspicious findings. This facilitated a medical con-

sultation service as well. In this way there was little tax on the local medical staff.

Records were managed in the routine manner, i. e., the medical personnel staff were asked to fill out NAVMED H-8 with the man's full name, service or file number, State, and date of birth. These forms were placed in alphabetical sequence regardless of division so that as the men reported for x-ray it was a fairly simple matter to pick out the individual H-8. As individuals were handed their H-8's they were instructed to check the accuracy of the information contained thereon, and in case of errors to make changes.

When this was done, the men were lined up in single file and as they passed a desk, the x-ray file number was assigned on the individual H-8, using a numbering machine. At the x-ray machine it was necessary to check each H-8 for correct sequence and place the numbers on the photofluorographic tunnel.

After the films had been taken and processed, the permanent station x-ray log was typed, using the individual H-8 as a guide, so that the log and the H-8 were kept in the same sequence at all times until the records were processed completely.

After the films had been read, using the x-ray log as a guide, the log was used to select the H-8's of the suspicious cases and the ones with commentary findings. This left only the ones to be reported as negative.

The suspicious cases were requested to return for 14 by 17 examination and, where necessary, for medical consultation. When these films had been processed and read, the report together with a memorandum was sent to the medical record office for entry in the individual health records. One copy of the memorandum was forwarded to the Bureau of Medicine and Surgery and one copy to the Photofluorographic Unit at Pearl Harbor to be filed with the films in the regular x-ray files.

It was necessary to begin from 00001 since the regular Photofluorographic Unit at Pearl Harbor was still functioning and there would be danger of duplicating numbers if an attempt were made to keep the same sequence as that unit.

The station complement, the number of patients and the findings are best reported in table 3:

TABLE 3

Station, NAS NOB Midway Islands

Complement, approximate.....	700
Number requiring photofluorograms.....	337
Number examined by photofluorograms.....	337
Number reexamined because of technically unsatisfactory films.....	17
Number reexamined by 14 by 17 film.....	19

Findings

1. Tuberculosis:	
(a) Primary type (stable)	5
(b) Reinfection type (inactive):	
1. Minimal	1
2. Moderately advanced	1
2. Others:	
(a) Increased lung markings	3
(b) Azygos lobes	3
(c) Pleural thickening	2
(d) Cervical ribs	1

The patients with reinfection type tuberculosis were instructed to return for 3-month interval chest film examinations.

The trip to Midway Islands showed that an air-borne photofluorographic service is possible and seemed to be at least one adequate answer to the problem of mass chest x-ray examination of personnel stationed for longer tours of duty on the outlying island naval and marine bases in this Pacific Area.



NOTES ON CONTRIBUTORS¹



Barnes, La Verne A., Commander (MSC) USN (*Prolonged Laboratory Observations on Clinical Cases and Carriers of "Shigella flexneri III" Following an Epidemic*, p. 405). B. S., 1925, M. S., 1928, and Ph. D., 1929, State College of Washington. Demonstrator in bacteriology, Western Reserve School of Medicine, 1925-26; teaching fellow in bacteriology, State College of Washington, 1926-29; senior instructor in bacteriology, Western Reserve School of Medicine, 1929-31; senior bacteriologist, Massachusetts Department of Public Health, 1931-47; assistant in preventive medicine, Harvard Medical School and School of Public Health, 1931-42. Appointed lieutenant, H-V(S) USNR, 21 Feb. 1942; transferred to Regular Navy 19 Oct. 1947. Served at U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md., and U. S. Naval Medical Research Institute, Bethesda, Md. Fellow: American Public Health Association; member: Society of American Bacteriologists, American Association of Immunologists, and Massachusetts Public Health Association. Coauthor, *Biology of Pneumococcus*, Commonwealth Fund, 1938.

Bullwinkel, Henry G., Captain (MC) USN (*Pterygium: A Simple Efficient Method of Treatment*, p. 395). B. S., Columbia University, 1918; M. D., Columbia University College of Physicians and Surgeons, 1920. Intern, Roosevelt Hospital, New York, N. Y., 1920-21; resident, 1928-29, and staff, otolaryngology and bronchoscopy, St. Luke's Hospital, New York, N. Y.; staff, ophthalmology, New York Eye and Ear Infirmary, New York, N. Y. Appointed assistant surgeon, USNR, 10 July 1923; transferred to Regular Navy, Apr. 1947. Specialty: Ophthalmology, otology, laryngology, and rhinology. Served on U. S. S. *Prairie* and U. S. S. *Hoggatt Bay*; at U. S. Naval Air Station, Coco Solo, Canal Zone; Tutuila, American Samoa; and U. S. Naval Hospital, Brooklyn, N. Y. Fellow: New York Academy of Medicine, American College of Surgeons, American Academy of Ophthalmology and Otolaryngology, and American Laryngology, Rhinology, and Otolaryngology Society. Diplomate: American Board of Otolaryngology.

Cureton, Murphy K., Captain (MC) USN (*Medical Matériel Logistics in the United States Navy*, p. 353). B. S., Lincoln Memorial University, 1926; M. D., Emory University School of Medicine, 1931. Professor, Natural Science, Lincoln Memorial University, 1926-27; intern, U. S. Naval Hospital, Chelsea, Mass., 1931-32; resident in pediatrics, Boston Floating Hospital, Boston, Mass., 1932. Appointed assistant surgeon, USN, June 1931 from Georgia. Served at U. S. Naval Medical Supply Depot, Oakland, Calif., and U. S. Naval Medical Supply Depot, Pearl Harbor, T. H.; at Army-Navy Medical Procurement Office, Brooklyn, N. Y. Fellow: American Medical Association.

¹ This section of the BULLETIN will be discontinued after this present issue because of the difficulty in obtaining information from authors who are on ships and stations in all parts of the world.

Dierkhising, O. C., Chief Hospital Corpsman, USN (*The Spread of Influenza A and Other Acute Respiratory Diseases*, p. 478). Enlisted 14 Apr. 1935 as hospital apprentice; appointed chief pharmacist, Sept. 1944. Specialty: Laboratory technician, U. S. Navy; completed a course in epidemiology and tropical medicine at the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.; course in virus at Johns Hopkins School of Hygiene and Sanitation. Preservice education consisted of completed grammar school and 3 years of high school. Served on U. S. S. *Medusa*; at U. S. Naval Hospital, Mare Island, Calif.; U. S. Naval Training Center, Great Lakes, Ill.; U. S. Naval Hospital, Great Lakes, Ill.; overseas duty in Darwin, NWT, Australia, and Perth, West Australia; twice detached for duty with Australian Army for investigation of dysentery epidemic; served as sanitation officer, Sidney, Australia; served at Hospital Corps School, Farragut, Idaho; with Epidemiology Unit No. 20 at Camp LeJeune, N. C.; Epidemiology Unit No. 105 at Guam, M. I., and Tokyo Bay, Japan; with Epidemiology Unit No. 13, Great Lakes, Ill. Member: American Medical Technologists and Tokyo Bay Medical Society.

Engelfried, John J., Commander (MSC) USN (*Production of Anti-Rh Sera From Placental Tissue of Sensitized Women*, p. 370). B. S., 1932, M. S. P. H., 1934, and D. P. H., 1936, University of Michigan. Instructor, clinical chemistry and bacteriology, Department of Pediatrics and Infectious Diseases, University of Michigan Medical School, 1934-41. Appointed lieutenant, H-V(S), USNR, 14 June 1941 from Michigan; transferred to Regular Navy 17 Oct. 1947. Served at U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md. Member: American Association for the Advancement of Science, American Public Health Association, and Michigan Academy of Science, Arts and Letters.

Fowler, John A., Lieutenant, junior grade (MC) USNR (*Sulphadiazine Anuria*, p. 448). B. S., Wake Forest College, 1943; M. D., Bowman Gray School of Medicine of Wake Forest College, 1946. Intern, U. S. Naval Hospital, Corpus Christi, Tex., Mar. 1946-Apr. 1947. Enlisted as apprentice seaman, V-12 (S), USNR, 12 July 1943; appointed assistant surgeon, USNR, 27 Mar. 1946. Served at U. S. Naval Hospital, Corpus Christi, Tex., and at U. S. Naval Dispensary, U. S. Naval Air Station, Saipan, M. I.

Henry, Fredrick R., Chief Hospital Corpsman, USN (*Production of Anti-Rh Sera From Placental Tissue of Sensitized Women*, p. 370). B. S., Colorado State College of Agriculture and Mechanic Arts, 1947. Botanist-biologist, Colorado Water Conservation Board, Denver, Colo., 1939. Enlisted as hospital apprentice, first class, U. S. N. R., 6 Jan. 1942; transferred to Regular Navy 26 Aug. 1942. Specialty: Laboratory technician, U. S. Navy. Served at U. S. Naval Dispensary, Long Beach, Calif.; on U. S. S. *Griffin*; at U. S. Naval Hospital Corps School, Portsmouth, Va., and at U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

Hicks, Samuel P., Lieutenant Commander (MC) USN (*Rupture of the Spleen in Infectious Mononucleosis*, p. 460). M. D., University of Pennsylvania School of Medicine, 1940. Appointed assistant surgeon, USNR, 17 July 1942; transferred to Regular Navy 6 Sept. 1942. Specialty: Pathology. Served at Mobile Hospital No. 11 and at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Resigned 17 Feb. 1947.

Hungate, Carroll P., Captain (MC) USNR (*The First Maritime Hospital and the Second Oldest Hospital in the New World, Translation of*, p. 437). A. B., 1925, and B. S., 1928, University of Kansas; M. D., University of Kansas

School of Medicine, 1928. Intern, U. S. Naval Hospital, Chelsea, Mass., June 1928–June 1929. Graduate medical courses, University of Munich, University of Vienna and Bratislava. Appointed assistant surgeon, USN, 5 June 1928; resigned 12 Sept. 1930; appointed passed assistant surgeon, USNR, 28 Aug. 1933. Served at U. S. Naval Air Station, Dallas, Tex.; U. S. Naval Air Station, Corpus Christi, Tex.; with 9th Marine Aircraft Wing, Fleet Air Wing 16, and with the Joint Brazil-United States Military Commission in Rio de Janeiro, Brazil.

Jarrett, Elma T., Lieutenant (HC) USN (*The Spread of Influenza A and Other Acute Respiratory Diseases*, p. 478). Enlisted 3 June 1927 as hospital apprentice; appointed to commissioned rank 15 May 1943 from Tennessee. Specialty: Epidemiology and sanitation; clinical laboratory technique. Served at U. S. Naval Hospital, San Diego, Calif.; with epidemiology unit, Memphis, Tenn.; and medical research unit, U. S. Naval Training Center, Great Lakes, Ill. Certified as medical technologist by Board of Registry, American Society of Clinical Pathologists.

Jessner, Max, M. D. (*Clinical Cases for Diagnosis*, p. 434). M. D., 1910, Universities of Königsberg and Munich. Assistant, Hygiene Institute of University of Königsberg, University Hospitals for Internal Medicine and for Dermatology and Venereology resp., Breslau, 1910–11; assistant, University Hospital and Clinic for Dermatology and Venereology, Berne, 1912–14; chief of clinic, University Hospital and Clinic for Dermatology and Venereology, Breslau, 1920–31; full professor of dermatology and venereology, University of Breslau, 1931–1935; professor emeritus, 1935; instructor in dermatology and syphilology, New York Post-Graduate Medical School and Hospital (Skin and Cancer Unit), 1941; associate, 1943, and assistant professor, 1946, New York Post-Graduate Medical School; assistant attending, New York Post-Graduate Hospital. Fellow: American Medical Association; member: Society for Investigative Dermatology, Rudolf Virchow Society, and Bronx Dermatological Society.

Kingston, James R., Commander (MC) USN (*The Spread of Influenza A and Other Acute Respiratory Diseases*, p. 478). B. S., University of Minnesota, 1926; M. D., University of Minnesota Medical School, 1930; M. P. H., Harvard School of Public Health, 1939. District health officer, State of Minnesota, 1936–42. Appointed passed assistant surgeon, USNR, 12 Mar. 1942 from Minnesota; transferred to Regular Navy, August 1946. Specialty: Public health and epidemiology. Served at U. S. Naval Base Hospital No. 6; in South Pacific Theatre; at U. S. Naval Hospital, U. S. Naval Training Center, Great Lakes, Ill.; and with Epidemiology Unit No. 13, U. S. Naval Training Center, Great Lakes, Ill. Member: American Medical Association.

Loré, John M., Jr., Lieutenant, junior grade (MC) USNR (*Air-Borne Photo-fluorographic Unit*, p. 490). M. D., New York University College of Medicine, 1945. Appointed ensign, H-V (P), USNR, 25 Feb. 1943; classification changed to apprentice seaman, V-12 (S), USNR, 11 May 1943; appointed assistant surgeon, USNR, 13 June 1945. Served at U. S. Naval Hospital, Camp Lejeune, N. C., and U. S. Naval Receiving Station, Pearl Harbor, T. H.

Liedman, Sidney C., Commander (DC) USN (*The Treatment of Fractures of Edentulous Mandibles*, p. 415). D. D. S., Chicago College of Dental Surgery, Loyola University, 1936. Private practice, dentistry, Chicago, Ill., 1936–39. Appointed lieutenant, junior grade (DC) USN, 15 Sept. 1939 from Illinois. Served at U. S. Naval Hospital, Portsmouth, Va., and U. S. Naval Hospital,

Newport, R. I.; served on U. S. S. *Solace*. Member: American Dental Association.

Lowe, Edward S., Captain (MC) USN (*Traumatic Rupture of the Mesentery of a Meckel's Diverticulum*, p. 467). M. D., University of Colorado School of Medicine, 1929. Intern, Colorado Psychopathic Hospital, Denver, Colo., June 1928-June 1929; U. S. Naval Hospital, San Diego, Calif., July 1929-Aug. 1930. Appointed assistant surgeon, USN, 26 June 1929. Specialty: Surgery and pathology. Served at U. S. Naval Hospital, San Diego, Calif., U. S. Navy Convalescent Hospital, Asheville, N. C., U. S. Naval Hospital, Philadelphia, Pa., U. S. Naval Hospital, Long Beach, Calif., U. S. Naval Hospital, Canacao, P. I., and U. S. Naval Hospital, Aiea Heights, T. H.; and on U. S. S. *San Francisco*, U. S. S. *Idaho*, U. S. S. *Henderson*, and U. S. S. *Palos*. Fellow: American College of Surgeons and American Medical Association.

Magiera, Stephen L., Lieutenant, junior grade (MC) USNR (*Reiter's Disease*, p. 463). B. S., Creighton University, 1943; M. D., Creighton University School of Medicine, 1944. Intern, 1944-45, and assistant resident in medicine, 1945-46, St. Louis City Hospital, St. Louis, Mo. Appointed ensign, H-V (P), USNR, June 1942; classification changed to apprentice seaman, V-12 (S), USNR, July 1943; appointed assistant surgeon, USNR, 22 Sept. 1944. Served at U. S. Naval Hospital, Oakland, Calif., and on U. S. S. *Repose*.

Marsh, William C., Commander (MC) USN (*Dermatitis Due to the Preparation and Administration of Penicillin Solution*, p. 391). B. S., University of Toledo, 1936; M. D., Ohio State University College of Medicine, 1940. Intern, Kings County Hospital, Brooklyn, N. Y., July 1940-July 1941. Appointed assistant surgeon, USN, 4 Aug. 1941 from New York. Specialty: Dermatology and syphilology. Served on U. S. S. *Tennessee*; and at U. S. Naval Hospital, Chelsea, Mass., and U. S. Naval Hospital, Philadelphia, Pa.

McCann, William J., Jr., Lieutenant, junior grade (MC) USNR (*Prolonged Laboratory Observations on Clinical Cases and Carriers of "Shigella flexneri III" Following an Epidemic*, p. 405). M. D., New York University College of Medicine, 1945. Appointed assistant surgeon, USNR, 13 June 1945. Served at U. S. Naval Air Station, Palmyra Island, and at U. S. Naval Hospital, Aiea Heights, T. H.

New, William N., Commander (MC) USN (*Dermatitis Due to the Preparation and Administration of Penicillin Solution*, p. 391). B. A., Central State Teachers College, 1931; B. Sc., University of Oklahoma; M. D., University of Oklahoma School of Medicine, 1934. Intern, Southern Pacific General Hospital, San Francisco, Calif., 1934-35. Appointed assistant surgeon, USN, 5 Sept. 1935 from Oklahoma. Served with First Marine Division at Guadalcanal and at Medical Field Research Laboratory, Camp Lejeune, N. C.

Philbrook, Frank R., Commander (MC) USN (*Prolonged Laboratory Observations on Clinical Cases and Carriers of "Shigella flexneri III" Following an Epidemic*, p. 405). M. D., Boston University School of Medicine, 1935; M. P. H., Harvard University School of Public Health, 1940. Intern, pathology, 1935-36, and intern, medical and surgical services, 1936-37, Massachusetts Memorial Hospitals, Boston, Mass.; resident physician, Somerville Hospital, Somerville, Mass., 1937; epidemiologist, Massachusetts Department of Public Health, Boston, Mass., 1937-; instructor in bacteriology, pathology, and thanatology, New England Institute of Sanitary Science and Embalming, 1933-38. Appointed passed assistant surgeon, USNR, 9 Feb. 1940 from Massachusetts; transferred to Regular Navy July 1946. Served on U. S. S.

Tripoli and at Marine Corps Air Station, Quantico, Va. Member: Massachusetts Medical Society, Massachusetts Public Health Association, American Public Health Association, and Aero Medical Association of the United States.

Requarth, William, Commander (MC) USNR (Inactive) (*Use of Pedicle Skin Grafts in Repair of Surface Defects of the Lower Extremities*, p. 373). B. S., University of Illinois, 1936; M. D., 1939, and M. S. in surgery, 1940, University of Illinois College of Medicine. Intern, St. Luke's Hospital, Chicago, Ill., July 1938-July 1939; fellow in surgery and instructor in surgical anatomy, University of Illinois College of Medicine and Research and Educational Hospital of the University of Illinois, Chicago, 1939-40; resident in surgery, Cook County Hospital, Chicago, 1940-41 and 1946-47. Appointed assistant surgeon, USNR, 2 Aug. 1941. Served with Submarine Squadron Four, Pearl Harbor, T. H.; U. S. Naval Forces in Europe: Fighting Squadron 31; on U. S. S. *Cabot*; and at U. S. Naval Hospital, Great Lakes, Ill. Released from active duty 3 Apr. 1946. Instructor in surgery, University of Illinois College of Medicine, Apr. 1947-; associate attending surgeon, Cook County Hospital, Chicago, Ill.; consulting surgeon, Veterans' Hospital, Hines, Ill.; surgical staff, St. Joseph's Hospital, Chicago, Ill., and St. Catherine's Hospital, East Chicago, Ill.; associate surgeon, Henrotin Chicago, Ill. Fellow: American College of Surgeons; member: Illinois State Medical Society, Chicago Medical Society, and American Society for Surgery of the Hand. Diplomate: American Board of Surgery.

Schafer, Walter L., Commander (MC) USNR (Inactive) (*Streptothricosis*, p. 399). A. B., Capital University, 1934; M. D., Ohio State University College of Medicine, 1937. Intern, Ohio Valley General Hospital, Wheeling, W. Va., 1937-38; resident in pediatrics, Children's Hospital, Columbus, Ohio, 1938-39; chief resident in pediatrics, T. C. Thompson Children's Hospital, Chattanooga, Tenn., 1939-40; fellowship in medicine, Wheeling Clinic, Wheeling, W. Va., 1940-41; pediatric resident, Dr. Henry John's Camp for Diabetic Children, Cleveland, Ohio, 1940. Appointed assistant surgeon, USNR, 20 Nov. 1940. Served at U. S. Naval Dispensary, Navy Department, Washington, D. C., and U. S. Naval Hospital, Quantico, Va. Released from active duty 10 Apr. 1946. Fellow: American College of Physicians; American Academy of Pediatrics. Diplomate: American Board of Pediatrics.

Story, Clifford F., Captain (MC) USN (*Sulfadiazine Anuria*, p. 448). B. S., Tulane University of Louisiana, 1928; M. D., Tulane University of Louisiana School of Medicine, 1930; M. Sc. (medical science), University of Pennsylvania, 1940. Appointed assistant surgeon, USN, 24 June 1930 from Louisiana. Specialty: Surgery. Served at U. S. Naval Hospital, Great Lakes, Ill.; U. S. Naval Hospital, Shoemaker, Calif.; U. S. Naval Hospital, Norman, Okla.; U. S. Naval Hospital, Corpus Christi, Tex. Fellow: American College of Surgeons; member: American Medical Association.

Sulzberger, Marion B., Captain (MC) USNR (Inactive) (*Clinical Cases for Diagnosis*, p. 434). Harvard University, 1916; B. M. S., Sorbonne, Paris, 1922; M. D., Universität Zurich Medizinische Fakultät, 1926. Assistant, University Clinic (dermatology and syphilology), Zurich, 1926-29; Breslau, 1929; instructor in dermatology, 1929-35, assistant professor in clinical dermatology, 1935-38, and assistant clinical professor in dermatology and syphilology, 1938-46; associate attending dermatologist, 1935-38, attending dermatologist, 1938-47; director, Department of Dermatology and Syphilology, Skin and Cancer Unit, 1946-, New York Post-Graduate Medical School and Hospital; associate attending dermatologist, Montefiore Hospital for

Chronic Diseases, New York City, 1931-46; director, dermatology and syphilology department, 1934-38, and consultant in dermatology, 1938, French Hospital, New York, N. Y.; visiting physician, Goldwater Memorial Hospital for Chronic Diseases, Welfare Island, New York, N. Y., 1941-46; research associate in medicine, Cornell University Medical College 1942-. Appointed surgeon, USNR, 13 Mar. 1940. Specialty: Dermatology. Served at U. S. Naval Hospital, Philadelphia, Pa., and U. S. Naval Hospital, Brooklyn, N. Y.; National Research Council, Naval Research Unit, Cornell Medical College; U. S. Naval Medical Research Unit No. 2, Guam. Released from active duty 15 Jan. 1946. Consultant in dermatology and syphilology, Bureau of Medicine and Surgery, U. S. Navy. Fellow: American Medical Association and New York Academy of Medicine; member: American Dermatological Association, American Academy of Dermatology and Syphilology, American Association for the Study of Allergy, American Association of Immunologists, Bronx Dermatological Society, Society for Experimental Biology and Medicine, Society for Investigative Dermatology, and Society for Research in Psychosomatic Problems. Editor, Year Book of Dermatology and Syphilology, Year Book Publishers, Inc., Chicago, Ill., 1931-; Board of Editors, Journal of Allergy, Psychosomatic Medicine, Dermatologica; editor, Journal of Investigative Dermatology, 1938. Author, Dermatologic Allergy, Charles C. Thomas, Springfield, Ill., 1938; coauthor, Dermatologic Therapy in General Practice, Year Book Publishers, Inc., Chicago, 1940; 2d edition, 1942; 3d edition, 1948; coauthor, Manual of Dermatology (Military Medical Manuals, National Research Council), W. B. Saunders Co., Philadelphia, Pa., 1942.

Zarriello, Jerry J., Lieutenant, junior grade (MC) USNR (*Discussion of Pulmonary Tuberculosis Treated With Phrenic Crush and Pneumoperitoneum Therapy*, p. 454). A. B., Columbia University, 1941; M. D., Long Island College of Medicine, 1944. Intern, Lenox Hill Hospital, New York, N. Y., Sept. 1944-July 1945; resident, Metropolitan Hospital, Welfare Island, New York, N. Y., July 1945-Mar. 1946. Appointed ensign, H-V (P), USNR, May 1942; classification changed to apprentice seaman, V-12 (S), USNR, Aug. 1943; appointed assistant surgeon, USNR, Sept. 1944, from New York. Served at U. S. Naval Hospital, Corona, Calif. Member: American Medical Association, Bronx County Medical Society. Diplomate: National Board of Medical Examiners.



70

UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

E 48

NUMBER 4



JULY-AUGUST 1948

Bimonthly

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED P-112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

**A beautiful palm-lined vista at
U. S. Naval Base Hospital No. 3,
Espirtu Santo, New Hebrides.**

—Official U. S. Navy Photo.

UNITED STATES NAVAL MEDICAL BULLETIN

THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE



BIMONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriations Act for fiscal year 1948,
Public Law No. 202, approved July 18, 1947

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1948

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.



Because the supply of certain numbers of the BULLETIN is exhausted and because of the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, No. 5.

Volume 17, 1922, No. 4.

Volume 18, 1923, Nos. 1, 3, and 5.

Volume 19, 1923, No. 3.

Volume 20, 1924, No. 5.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, No. 1.

Volume 26, 1928, Nos. 1 and 3.

Volume 31, 1933, No. 3.

Volume 42, 1944, Nos. 2 and 6.

Volume 44, 1945, No. 6.

March 1946 Supplement.

Volume 47, 1947, No. 6.



SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$2.50; foreign subscription, \$3.25.

Single number, 50 cents.

Exchange of publications will be extended to medical and scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

II

PREFACE



The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

CLIFFORD A. SWANSON,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS



Contributions to the **BULLETIN** should be typewritten, double-spaced, on plain paper of standard letter size and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions and the style laid down in the Government Printing Office Style Manual for spelling, abbreviations, capitalization, and the use of figures.

All pictures should be unmounted. Do not cut out portions of illustrations to be reproduced. Photographs should be black and white glossy prints, preferably 4 by 5 or 8 by 10 inches to allow for reduction. Do not make any marks on face of photograph nor type or write on back as these impressions show through and may mar the picture. Staples, paper clips, or pins should not be used on illustrations. All charts and graphs must be drawn with black india ink on white paper. If graph lines are to appear they should be in other than blue printing ink.

Contributions are to be the original work of the author and great care should be exercised to enclose in quotation marks quotations which may be introduced. Full credit for the source for these quotations should also be given. Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the **BULLETIN** should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps,
United States Navy, Ret., Act.

TABLE OF CONTENTS



	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

A Discussion of Reiter's Syndrome With Report of a Case—Clifford A. Swanson and Adrian J. Delaney	503
The Formation of Phage in Cell-Free Preparations—Albert P. Krueger, Theodore Cohn, Philip N. Smith, and Charles D. McGuire	510
The Nonoperative Treatment of Acute Empyema Thoracis With Penicillin; a Discussion of Its Limitations and Subsequent Surgical Management of Its Failures—Robert B. Brown and Robert K. Moxon	513
Dental Logistics in Amphibious Operations—Frances G. Ulen	528
Persisting Ocular Defects in Pacific War Prisoners—Everett J. Olenick	538
Six Atypical Cases of Syphilis—James F. Morrell	547
Neuropsychiatric Screening of a Million Men—Elbert C. Reitzel, Vernon L. Miller, and George W. Knox	555
A Rapid Technique for the Diagnosis of Scabies—Cedric C. Carpenter	566
CLINICAL PATHOLOGICAL CONFERENCE	569

NAVAL MEDICAL HISTORY

A Wartime Log of the United States Naval Hospital Ship "Solace" From June 1943; Part I—Eugene H. Drake, William W. Strange, Howard B. Sprague, and Arthur P. McGinty	577
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

EDITORIALS

Mission of Medical Department, U. S. Navy	594
New Paths in the Treatment of Leprosy	595
Drowning in Salt and Fresh Water	595
The Truth About Marihuana	596
The History of the Health Record	597

	Page
NOTICES OF DEATHS IN MEDICAL AND DENTAL CORPS.....	600

CLINICAL NOTES

Total Cystectomy With Bilateral Ureterosigmoidostomy for Carcinoma of the Bladder— <i>Clifford F. Storey and A. T. Talley, Jr</i>	601
Chorioretinitis Juxtapapillaris (Jensen's Disease)— <i>Henry G. Bullwinkel</i> ..	610
Meningococcal Meningoencephalitis; Report of a Case— <i>James C. Humphrey and Harwell G. Davis, Jr</i>	613
Pseudohemophilia; Report of a Case Simulating Acute Appendicitis— <i>George L. Calvy</i>	616
Encephalitis Due to Antirabies Vaccine; Report of a Case— <i>Alvin M. Siegler</i> ..	620

BOOK NOTICES

Textbook of the Ear, Nose, and Throat, Lederer and Hollender—Diseases of the Nose and Throat and Ear, Ballenger and Ballenger—Science Since 1500, Pledge—Endocrinology of Neoplastic Diseases; eighteen authors; edited by Twombly and Pack—Atlas of Bacteriology, Low and Dodds—Disability Evaluation, McBride—The Practice of Mental Nursing, Houlston—Color Atlas of Hematology, Kracke—Utero-Tubal Insufflation, Rubin—The Premature Baby, Crosse—Nursing, Wolf	626
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

PREVENTIVE MEDICINE

Medical Surveys for Pulmonary Tuberculosis— <i>Sidney A. Britten and Carl J. Heisser</i>	632
Concentration of Grouping Serum for Group "A" Hemolytic Streptococci— <i>James T. Prince</i>	641
Outbreak of Scarlet Fever and Sore Throats Aboard the U. S. S. "Oregon City"— <i>Ralph R. Tyson</i>	643

***Commanding Officer, Executive Officer, and Civilian Consultants
at U. S. Naval Hospital, Philadelphia, Pa.¹***



Inner circle, reading from left to right: Charles C. Chapple, J. Gershon-Cohen, Edward A. Schumann, Theodore E. Orr, Robert D. Dripps, Fred D. Weidman, Frederick S. Schofield, Richard A. Kern, Howard E. Twining, Robert F. Norris, Edward H. Campbell, John H. Willard, Charles A. W. Uhle, Bernard J. Alpers, and James P. Lewis.

Outer circle, reading from left to right: J. A. Crellin, Temple Fay, Edmund B. Spaeth, Clark E. Brown, Harry H. Pote, Robert H. Ivy, Abraham Cantarow, L. Kraeer Ferguson, R. Phillip Custer, Martin P. Crane, Louis H. Clerf, and Joseph Hughes.

Bottom center, left, Capt. Howard H. Montgomery, U.S.N., commanding officer; right, Capt. G. E. Gayler, executive officer.

¹ Since this composite picture was made Dr. Lauren H. Smith was appointed as a consultant in neuropsychiatry.



WASHINGTON 25, D. C.

21 July 1946



Fellow Officers of the Medical Department:

The care of the sick and injured of the Navy in peace and war is the mission of the Medical Department of the Navy. The extent of that mission is sometimes scarcely realized and for this reason a review of the size of the task will be good for all of us.

Medical care for the Navy covers all officers and men of the Navy, midshipmen, and also all officers and men of the Marine Corps. This includes medical facilities on ships of all sizes and character from battleships to submarines and in every ocean. Medical service is supplied to the air arm of the Navy and Marine Corps. Naval stations, large and small, either in the United States or on small atolls far overseas must have doctors.

In caring for the families of the officers or men, the Medical Department has one of the largest general practices in the world. More than three quarters of a million dependents receive medical care, and in one year nearly 25,000 babies are delivered by doctors of the Navy. House calls number over 40,000 and office calls about one and a quarter million. Between two and three million prescriptions are dispensed through Navy pharmacies in an average year.

The emergency care of all civilian workmen in our naval shore establishments is also provided, and as this represents a very large number of persons, their treatment and the records required for civilian compensation claims are not inconsiderable. The prevention and treatment of industrial accidents and diseases form a part of this work.

In any organization so large as the Navy with so many contacts throughout the world, there are numerous miscellaneous activities and duties that become a part of its responsibilities. Care of members of the State Department in foreign countries in which naval medical personnel are available, physical examinations and the giving of protective inoculations are part of this task.

The medical care of the native populations of the mandated islands of the Pacific, numbering about 100,000, are another responsibility of the Medical Department of the Navy. Scattered as they are over the world's largest ocean, and in an area where many tropical diseases are endemic, the inhabitants of these islands present a special problem in medical practice of great interest and importance.

In the Navy also preventive medicine looms as one of the Medical Department's largest activities and employs a considerable number of specialists and technicians in public health.

The medical care given is also the best to be obtained. All medical officers are graduates of Class A Medical Schools and all other members of the Medical Department are from only properly recognized, accredited colleges and schools and all are carefully screened on entrance to the Navy. Such institutions for the care of the sick as the great National Naval Medical Center at Bethesda or naval hospitals such as that at San Diego, as to buildings, equipment, instruments and staff, are not surpassed anywhere in the world. This uniformly high standard of medical care is given to admiral or recruit, members of families, civilian workmen, or natives of mandated areas in the Pacific. The quality of this medical care is best appreciated also when it is realized that it is far above the average level in the civilian population, where considerable numbers do not even avail themselves of professional medical care but seek it from nonprofessional groups. The medical standards of the Medical Department of the Navy require that only the best will suffice in the treatment of the patients intrusted to its care.

Sincerely,

Rear Admiral, Medical Corps
Surgeon General, United States Navy

U. S. NAVAL MEDICAL BULLETIN

VOL. 48

JULY-AUGUST 1948

No 4

*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



A DISCUSSION OF REITER'S SYNDROME WITH REPORT OF A CASE

CLIFFORD A. SWANSON

Rear Admiral (MC) U. S. N.

and

ADRIAN J. DELANEY

Captain (MC) U. S. N.

THE syndrome of urethritis, conjunctivitis, and arthritis, first described by Reiter (*1*) in 1916, and identified with his name since that time, has evoked considerable discussion during the past few years. From the time of the original report until 1942, an occasional case was reported from Europe, but no cases were reported in the American literature.

In May 1942, Bauer and Engleman reported six cases of Reiter's syndrome, and expressed the hope that their report would stimulate further interest in the poorly understood clinical picture. Their hope has been more than fulfilled by the many reports in American and foreign literature since 1942. The majority of cases have appeared in young men of military age, many of whom were in the service when they became afflicted with the condition. No cases have been reported in the aged who might be expected to be beyond the age of sexual libido.

¹The policy of the U. S. NAVAL MEDICAL BULLETIN as printed on the cover of its first issue and maintained throughout the 41 years of its existence.

Only one case has been reported in a female up to the time of the present report. Cases have been reported by urologists, dermatologists, internists, and ophthalmologists, each specialist having a tendency to emphasize that portion of the syndrome which involved his particular field most noticeably. The original triad of symptoms has been enlarged upon in some articles and detracted from in others. Thus, the dermatologists have found that skin lesions, identical with those seen in gonorrhea, and usually described as keratosis blennorrhagica, are found in the so-called Reiter's disease not infrequently. Lever and Crawford (6) feel that it is impossible to differentiate the lesions of gonorrheal keratosis blennorrhagica from the lesions seen in Reiter's disease on a clinical basis alone. The absence of gonococci in Reiter's disease allows the diagnosis of keratosis blennorrhagica to be discredited. The urologist, who sees these cases first, because the presenting symptoms are usually related to the genito-urinary tract, is inclined to emphasize the genito-urinary aspects and complications that arise. Thus Colby (5) adds cystitis and prostatitis to the triad, while others have reported pyelitis and hydronephrosis. Many essayists have mentioned balanitis and balanoposthitis, so that the entire length of the genito-urinary tract has been indicted in the disease manifestations. The internists have emphasized the acute joint manifestations of the triad, with an occasional reference to electrocardiographic changes accompanying the more dramatic clinical signs and symptoms. Thus, Feiring (25) reports prolonged auriculoventricular conduction time as an occasional finding.

In the case report to be presented, the ophthalmological aspects of the triad were of considerable importance, but the patient was actually treated on the urologic service, and the most important symptoms and signs, from the patient's point of view, were referable to the joints.

With emphasis being placed first on the genito-urinary system, then on the organ of sight, on the joints, the skin, the heart, and various other organs and systems, it becomes difficult to define what we mean to include in the definition of Reiter's disease. In his original article (1) Reiter himself was impressed with the daily variations in temperature from 98.6° in the morning to 102.2° F. in the evenings, and with the nightly sweats of his patient. He found a spirochete in the blood stream which resembled *Spirochaeta pallida* grossly, but which had a peculiar piercing slow rotatory movement, and varied in size greatly. He proposed the name *Spirochaeta forans* for this organism, which has not been found by other investigators since his time. Reiter also noted that the onset of illness in his young German Army lieutenant was marked by a diarrhea, followed in 8 days by purulent urethritis, and 1 day later by joint pain and swelling, and purulent conjunctivitis. Reiter felt that many cases similar to the one he was

reporting were being treated throughout Germany as cases of arthritis or under other headings, and were not being recognized as examples of a new syndrome, which he proposed to call spirochetosis arthritica.

Two very interesting reports have been published by Hollander and coworkers on Reiter's syndrome (11) (18). In a hospital devoted largely to the treatment of rheumatic fever and allied diseases, they found the classical triad of urethritis, conjunctivitis, and arthritis in 32 cases, with nongonorrheal urethritis and arthritis in an additional 20 cases. This large number of cases seen in one hospital in a period of 2 years or less would make it appear that the condition is rather relatively common if we accept the criteria for diagnosis offered by these investigators. However, if we are to accept less than the complete clinical picture originally described by Reiter, we cannot ignore the report of Pelouze (2) who found 333 cases of nongonorrheal urethritis in a review of 1,083 case histories of purulent urethritis which he had treated before the days of penicillin. In this book, devoted exclusively to gonorrhea in the male and female, Pelouze did not mention Reiter's disease by name.

Before the literature on Reiter's disease becomes too voluminous, it would seem desirable to establish certain essential criteria for the diagnosis of the disease. Any other manifestations of disease which appear during the course of the typical urethritis-conjunctivitis-arthritis phenomena should be considered as complications and should not be allowed to interfere with or cause confusion in the basic pattern. Further work on the etiology is urgently needed. Whereas Reiter's spirochete has been fairly well eliminated as the causative agent, there are many diverse opinions as to the probable cause. The European investigators favor an allergic response to a dysentery bacillus, pointing to the antecedent diarrhea which occurs frequently. American authors have no unanimity of opinion as to the etiologic agent, but some (21) have suggested the possible relationship of a pleuropneumonia-like organism to the disease complex. A virus agent is a logical suggestion, which is undoubtedly being investigated. Most investigators have seemed willing to reject the gonococcus as the offending agent because it has never been found in the discharge of the urethra, or of the conjunctiva, or of the aspirated joint fluid. However, all of the manifestations of the disease except the occasional antecedent diarrhea have been found in gonorrhea. The disease has always occurred in young individuals in the age group of greatest heterosexual activity, and predominatingly in members of the Armed Forces who are characteristically vigorous and aggressive. Without wishing to become involved in the hypothetical discussion of a granular hybrid form of the gonococcus which could produce systemic manifestations in a sensitized individual, it would seem logical, at least to this essayist, to exhaust all the possibilities of a neisserian etiology before looking

elsewhere for a likely culprit. It is known that self-medication with sulfonamides and penicillin in prostitutes has caused a chemotherapy-resistant type of gonorrhea to occur in members of the armed forces. If further changes could be produced in the gonococcus by host environment or chemotherapy, it would help to explain the failure to find the typical organism with present-day methods of investigation. Further investigation of this problem is urgently needed.

It might be interesting to review some figures given by the Chief of the Medical Statistics Division of the Bureau of Medicine and Surgery. The incidence of Reiter's disease in the Navy and Marine Corps has been reported as follows:

Year	Cases reported
1944.....	0
1945.....	5
1946.....	15
1947.....	31
Total.....	51

The gradual increase in the number of cases reported has occurred at a time when the size of the Navy and Marine Corps has been diminishing. The interpretation of these figures should not be taken to mean that the condition known as "Reiter's disease" is on the increase, but rather that an increased awareness of such a condition has been acquired by the rank and file of naval medical officers, in the field, and in hospitals.

In viewing eight typical case reports submitted from various naval medical activities, it becomes apparent at once that the basic pattern of nonbacterial urethritis, conjunctivitis, and arthritis is present in each case. However, in one case, that of a severe manifestation of Reiter's triad in a 36-year-old commissioned officer, there were permanent joint changes in both hands and in the left foot and ankle, leading to ankylosis. Bony erosion was disclosed on x-rays of the involved joints 2 years after the initial symptoms had become manifest. This officer was brought before a naval retiring board and was found unfit for further active duty because of Reiter's disease. Such a precedent makes it imperative for the Navy to review all previous descriptions of this poorly understood syndrome for the purpose of determining its clinical boundaries and its possible permanent effects. Some thought has been given to the possibility of sending all cases of Reiter's disease to one naval hospital where adequate clinical and laboratory facilities would be made available for concentrated research on this increasingly important entity.

The following case report is offered as a typical example of the present-day conception of Reiter's disease.

CASE REPORT

R. B. S., a 44-year-old, single, white, male officer, was admitted 23 June 1947 with the diagnosis Urethritis, acute, nonvenereal. One week prior to admission, without recent sexual exposure, he had developed scanty, urethral discharge with no other symptoms or signs. Complete physical examination revealed a scanty serous urethral discharge, slight inflammation of meatal mucosa and skin, and two small elevated shallow ulcers on the corona. No other findings of significance were noted on admission.

Laboratory work on admission revealed negative Kahn, sedimentation rate of 3 mm. in 60 minutes, urine loaded with white blood cells, but otherwise negative; negative smear and culture from urethra; complete blood count normal limits. Four days later, rectal examination revealed some periprostatic induration and the expressed secretion contained 10 to 20 pus cells per high dry field. On the same day, conjunctival redness and infection, involving both the ocular and palpebral conjunctivae of both eyes were noted. There were photophobia and irritation, but no evidence of keratitis or uveal tract involvement. Cultures and smears from the conjunctiva showed no organisms. Mild silver protein was used for the conjunctivitis. Because the patient had been treated in June 1945 for urethritis, conjunctivitis, and arthritis, and again in March 1946 for Reiter's syndrome, it was felt that an effort should be made to prevent development of the full-blown entity. With this in mind, Benadryl was given to try to offset allergic manifestations, chemotherapy was used, and foreign protein fever therapy was tried cautiously. All therapy seemed to be of no avail. Several shallow ulcers developed on the glans penis, and corona, with considerable local swelling and edema.

Twenty days after admission the conjunctivitis was much worse, with considerable purulent discharge, redness, injection, photophobia, and moderate pain. Cultures remained negative. At this time the patient began to develop a painful swelling of the interphalangeal joint of the left thumb, with redness and heat.

There was some aching pain but no swelling in the left shoulder girdle. The urethritis continued unabated and the penile erosions became coalescent as time went on. Salicylates were somewhat helpful in relieving the arthritic pain, but no medication seemed to interfere with the course of the disease complex. Hyponychia were noted under the third and fourth finger nails of the left hand, and this condition spread to involve all nails of the hands and feet, resulting in eventual shedding of all the nails with subsequent regrowth.

On 18 July, 25 days after admission, a superficial punctate keratitis was noted in both eyes, but these lesions cleared up rapidly under cycloplegics and weak zinc sulfate drops. Streptomycin chemotherapy was given for a total dosage of 12 grams in 6 days with slight improvement of the urethritis, but with apparent increase in the arthritic symptoms and signs. The small joints of both thumbs and both great toes became involved, and the right wrist became acutely inflamed.

By 3 August the urethritis had subsided, and the eyes were asymptomatic, but the joint manifestations continued unabated, and new joints became involved. The right temporomandibular joint was quite painful and tender on use, but swelling and redness were not noted.

On 9 August the right hip became painful and the lumbosacral spine was tender and painful on extension.

On 19 August the left eye was found to present fully developed iridocyclitis with ciliary injection and tenderness, a small amount of plastic exudate, many cells in the anterior chamber, and deposits on the corneal endothelium. This inflammation subsided under cycloplegics and local heat. As the process in the left eye began to subside, the right eye began to present the same evidence of iridocyclitis, and went through the same sort of cycle as the left eye, with about the same duration of the signs of anterior uveal tract inflammation almost to the day, each eye in turn being actively inflamed for about 1 month. As the eye symptoms and signs subsided, the arthritic symptoms and signs subsided slowly, and the sedimentation rate, which had ascended from 3 millimeters per hour on admission to 28 millimeters per hour on 20 August, slowly returned to 3 millimeters per hour by mid-October. No further evidence of inflammation of the genito-urinary tract or of the eyes was seen, but arthritic pains and swelling and tenderness of the small joints of the thumbs and great toes recurred for many weeks.

At no time was any clue uncovered as to the identity of the etiologic agent responsible for this syndrome. Cultures of all discharges were negative. Gonococcus complement fixation tests were negative. Blood serology was negative. Repeated stool cultures were negative for enteric pathogens. Agglutination tests for brucellosis and tularemia were negative.

Repeated x-ray studies of all the involved joints showed no evidence of bone or joint pathology at any time.

A thorough search into the patient's past history revealed no habits or practices that might give rise to an altered reaction to the gonococcus. He was a bachelor of regular habits, an occasional drinker of alcoholic beverages, a moderate user of cigarettes, with less than the usual amount of sexual exposure, such exposures always being accompanied by mechanical prophylaxis. He had not had any diarrhea for 6 months prior to the onset of his present illness, but on the contrary, had experienced mild symptoms of intestinal unrest caused by constipation for 1 or 2 weeks previous to the onset of his present illness.

SUMMARY

1. A brief review is made of the history of Reiter's syndrome.
2. A case presenting a triad of urethritis, conjunctivitis, and arthritis is described.
3. Etiology is discussed and consideration particularly given to the gonococcus or a virus.
4. A plea is made for a more precise definition of the clinical boundaries of this loosely described syndrome.

REFERENCES

1. REITER, H.: Concerning a hitherto unrecognized spirochetal infection (spirochaetosis arthritica). *Deutsche med. Wchnschr.* **42**: 1535-1536, Dec. 14, 1916.
2. PELOUZE, P. S.: *Gonorrhea in the Male and Female*. 3d edition. W. B. Saunders Company, Philadelphia, Pa., 1939.
3. BAUER, W., and ENGLEMAN, E. P.: Syndrome of unknown etiology characterized by urethritis, conjunctivitis, and arthritis (so-called Reiter's disease). *Tr. A. Am. Physicians* **57**: 307-313, May 1942.
4. BEIGELBÖCK, W.: Zur Behandlung der Reiterschen Krankheit (Ruhrreumatismus). **69**: 803, Nov. 26, 1943.
5. COLBY, F. H.: Renal complications of Reiter's disease. *J. Urol.* **52**: 415-419, Nov. 1944.

6. LEVER, W. F., and CRAWFORD, G. M.: Keratosis blennorrhagica without gonorrhea (Reiter's disease?). *Arch. Dermat. & Syph.* **49**: 389-397, June 1944.
7. ROSENBLUM, H. H.: So-called Reiter's disease; triad of acute arthritis, conjunctivitis, and urethritis. *U. S. Nav. M. Bull.* **44**: 375-378, Feb. 1945.
8. LUCAS, R. L., and WEISS, H.: Gonorrheal syndrome without gonorrhea; Reiter's disease. *Arch. Ophth.* **34**: 97-98, Aug. 1945.
9. GERSH, ISADORE, and REICH, N. E.: Arthritis, urethritis, and conjunctivitis (Reiter's disease); case report with bacteriologic studies. **49**: 472-473, Aug. 1945.
10. MILLER, C. D. (Cleveland), and MCINTYRE, D. W.: Syndrome termed Reiter's disease (urethritis, conjunctivitis, and arthritis). *Ann. Int. Med.* **23**: 673-682, Oct. 1945.
11. HOLLANDER, J. L.; FOGARTY, C. W., JR.; ABRAMS, N. R.; and KYDD, D. M.: Arthritis resembling Reiter's syndrome; observations on 25 cases. *J. A. M. A.* **129**: 593-595, Oct. 27, 1945.
12. SARGENT, J. C.: Reiter's syndrome. *J. Urol.* **54**: 556-564, Dec. 1945.
13. STRACHSTEIN, A.: Reiter's disease—report of case successfully treated. *New York State J. Med.* **45**: 2190-2191, Oct. 15, 1945.
14. VALLEE, B. L.: Reiter's disease; review of literature, with presentation of case. *Arch. Int. Med.* **77**: 295-306, Mar. 1946.
15. KOSTER, M. S., and JANSEN, M. T.: Reiter's disease. *Nederl. tijdschr. v. geneesk.* **90**: 483-485, May 18, 1946.
16. DE JONG, J. A. (Amsterdam, Holland): Case of Reiter's syndrome. *Nederl. tijdschr. v. geneesk.* **90**: 357, Apr. 1946.
17. PRAKKEN, J. R., and HARTMAN, M.: Secondary oculo-urethro-articular syndrome (so-called Reiter's disease, enteric polyarthritis). *Nederl. tijdschr. v. geneesk.* **90**: 244-247, Mar. 30-Apr. 6, 1946.
18. HOLLANDER, J. L.: Diagnosis and treatment of Reiter's syndrome. *M. Clin. North America* **30**: 716-723, May 1946.
19. JACKSON, W. P. U.: Syndrome known as "Reiter's disease" (triad of polyarthritis, urethritis, and conjunctivitis). *Brit. M. J.* **2**: 197-199, Aug. 10, 1946.
20. WOOD, P.: Reiter's disease. *Brit. M. J.* **2**: 309, Aug. 31, 1946.
21. WALLERSTEIN, R.; VALLEE, B. L.; and TURNER, L.: Possible relationship of pleuropneumonia-like organisms to Reiter's disease, rheumatoid arthritis, and ulcerative colitis. *J. Infect. Dis.* **79**: 134-140, Sept.-Oct. 1946.
22. BAXTER, C. R.: Reiter's disease. *Brit. M. J.* **2**: 858, Dec. 7, 1946.
23. FORBES, D.: Case of Reiter's disease. *Brit. M. J.* **2**: 859, Dec. 7, 1946.
24. PASTINSZKY, I. (Debrecen, Hungary): Contributions to the Pathogenesis of Reiter's Syndrome. *Memorial Volume*, 1946.
25. FEIRING, W.: Reiter's disease with prolonged auriculoventricular conduction. *Ann. Int. Med.* **25**: 498-507, Sept. 1946.
26. KATZIN, H. M., and VALLEE, B. L.: Reiter's disease. *Am. J. Ophth.* **30**: 203-205, Feb. 1947.
27. PINCK, B. D.: Reiter's syndrome. *Am. J. M. Sc.* July 1947.
28. DUNHAM, J.: Reiter's disease. *J. Urol.* **58**: 212-215, 1947.



THE FORMATION OF PHAGE IN CELL-FREE PREPARATIONS ¹

ALBERT P. KRUEGER

Captain (MC) U. S. N. R.

THEODORE COHN

Lieutenant H(S) U. S. N. R.²

PHILIP N. SMITH

Chief Electrician's Mate U. S. N. R.²

and

CHARLES D. McQUIRE

UNDER the usual experimental conditions phage is produced by adding it in small amounts to a light suspension of susceptible organisms contained in a medium favorable to cellular reproduction. Upon incubation at a suitable temperature three outstanding developments occur: First, the turbidity of the mixture increases as the bacteria multiply; next, the phage content of the mixture rapidly rises; and finally, the cells undergo dissolution, leaving a clear fluid containing considerably more phage than was added initially.

Phage generally is considered to be a virus for which the host is the bacterium it attacks. Perhaps it would be preferable to employ plurals and to say that phages are viruses for they differ greatly in their properties and are surprisingly fastidious in their host selectivity. Since the system "phage-bacterium" provides a singularly convenient means of studying virus-host relationships of the simpler sort much work has been done with all varieties of phages and a multitude of bacterial types. The net result has been the accumulation of a considerable body of information covering the events from the sorption of phage by the cell to the ultimate massive lysis of the bacterial substrate.

Nevertheless we cannot state at present precisely how phage is formed. Earlier work was difficult to interpret because it was found that conditions supporting phage production also encouraged cellular reproduction; in fact Krueger and Northrop (1) developed an equation for phage formation in terms of bacterial growth. Recently a less complicated situation has become available through the independent observations of Dr. Winston Price at Rockefeller Institute and ourselves at the University of California to the effect that penicillin in a mixture of phage and susceptible staphylococci entirely inhibits cell

¹ From Office of Naval Research, Task Force 5, Department of Bacteriology, University of California, Berkeley.

² Inactive.

division without stopping phage formation. While it is feasible therefore to study phage production apart from the variations in milieu which inevitably accompany bacterial growth, one cannot state with certainty that the entire mechanism of events transpiring within the cell will be an end product of this approach.

Another phase of the phage problem has occupied our attention for a good many years; namely, the search for a hypothetical intracellular phage precursor from which phage is formed by autocatalysis. There exist experimental data which suggest the existence of such a material but unfortunately the evidence can be interpreted in other ways as well.

At any rate, regardless of hypothesis, experiment has shown that bacteria which have undergone a period of rapid growth and metabolic activity and subsequently are suspended in Locke's solution at 5° C. rapidly produce phage when added to phage-containing solutions (2). Such bacteria have been assumed to be a good source of phage precursor and up to the present many different types of extractive process were used for its recovery without consistent results. We now wish to describe a procedure which permits the reaction: $\text{phage} + X \rightarrow \text{phage}$ to occur entirely apart from phage susceptible cells. What X is we do not know nor can we be positive that it deserves the term precursor. All we can be sure of is that in a long series of experiments the material or materials released from bacteria can be separated from residual intact cells and that this sterile solution added to phage brings about the production of more phage.

The organism employed in these experiments is the K strain of *Staphylococcus aureus* and the phage is the one we have used in past experiments. Eighteen-hour cultures grown on agar in Roux flasks are harvested in tryptase-phosphate broth and an "activated" suspension is prepared by shaking the culture at 36° C. until the total count reaches approximately 1×10^9 cells/ml. The staphylococci are thrown down in the centrifuge and are resuspended in physiological saline solution at pH 6.6. Lysozyme is added to the cell suspension and the mixture is shaken at 36° C. until half the cells have lysed; this usually requires from 0.2 to 0.3 hour. The lysate is filtered immediately through a super-cel filter prepared according to the method of Krueger, Scribner and Brown (3) into a chilled flask. Samples are removed for sterility tests in broth and on solid media. 9 ml. aliquots of the filtrate are mixed with 1 ml. of phage diluted in saline solution. The mixtures are kept for from 10 to 20 minutes at 5° C. and the phage content of each is determined by the plaque count method of Gratia (4). At this time multiple samples are taken for determining the phage titer of the original solutions added to the filtrates.

Using single pipettes for each serial dilution and avoiding all the obvious variables, it has been possible to secure statistically significant increments in titer of the test mixtures. The experimental series have averaged yields of approximately 180 percent with occasional increases up to 400 percent. Controls have demonstrated that the increases noted are not due to the dispersion of phage aggregates into smaller units. However, it is possible to invoke another explanation for the increases in phage titer. If it is assumed that the original lysate contains an inactive phage fraction as well as active phage, it may be hypothesized that the bacterial extract functions to convert inactive phage into the active form. In this case, serial dilution of phage in successive aliquots of filtrate theoretically should exhaust the supply of inactive phage and should bring to a stop the progress of conversion into active phage. This has not been the case in our experiments but dilution of the original lysate has extended only to 1/12,500 and it could be postulated that some inactive phage still persisted.

Detailed experimental data will be published elsewhere.

REFERENCES

1. KRUEGER, A. P., and NORTHROP, J. H.: Kinetics of bacterium-bacteriophage reaction. *J. Gen. Physiol.* **14**: 223-254, Nov. 1930.
2. KRUEGER, A. P., and SCRIBNER, E. J.: Intracellular phage precursor. *J. Gen. Physiol.* **22**: 690-717, July 1939.
3. KRUEGER, A. P.; SCRIBNER, E. J.; and BROWN, B. B.: Further observations on mechanism of phage action. *J. Gen. Physiol.* **30**: 25-39, Sept. 1946.
4. GRATIA, A.: Des relations numériques entre bactéries lysogènes et particules de bacteriophage. *Ann. Inst. Pasteur* **57**: 652-676, Dec. 1936.



THE NONOPERATIVE TREATMENT OF ACUTE EMPYEMA THORACIS WITH PENICILLIN

A Discussion of Its Limitations and Subsequent Surgical Management of Its Failures

ROBERT B. BROWN
Commander (MC) U. S. N.

and

ROBERT K. MOXON
Lieutenant (MC) U. S. N.

THE literature contains many articles on the value of penicillin in the treatment of empyema of the thorax. It is not the purpose of this presentation to review the subject, this having been accomplished adequately by others (1). Suffice it to say that it has been established beyond doubt that many acute infections of the pleura may be treated by repeated thoracenteses for aspiration of purulent material and instillation of penicillin, and a cure effected without surgery (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12). However, on the basis of recent experience, we are forced to the conclusion that the limitations of this nonoperative method of treatment are not generally understood. It is our desire to supplement the work of others (13) (14) (15) in emphasizing these limitations. A few cases presented in brief will illustrate some of the points we wish to discuss.

CASE REPORTS

Case 1.—A 55-year-old white male was admitted on 30 March 1947. He had been treated at home for 3 weeks for "virus pneumonia," an illness characterized by fever, chills, cough, and delirium. He had received sulfonamides by mouth and penicillin intramuscularly.

Temperature on admission was 101.0° F. Pulse rate was 100, and respiratory rate 20. The patient was wasted, flaccid, and obviously acutely ill. He presented the signs of a large fluid collection in the right hemithorax.

Red blood cell count was 4,100,000 with 11.5 grams of hemoglobin. Leukocyte count was 23,000 with a normal differential count. Roentgenograms confirmed the clinical signs of a large encapsulated fluid collection, posteriorly located in the right hemithorax (fig. 1).

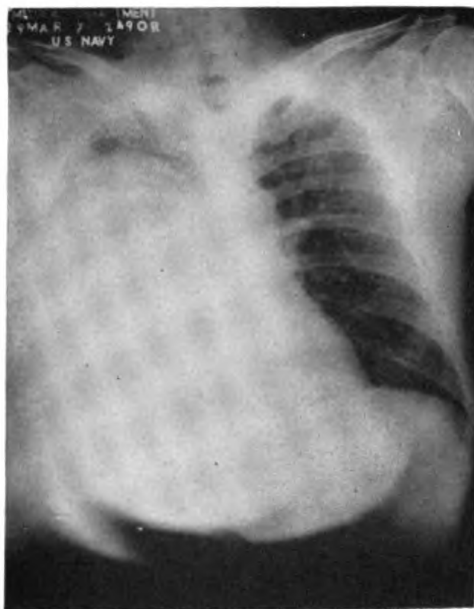


Figure 1.—Case 1. Roentgenogram taken prior to treatment. The large fluid collection in the right hemithorax is easily demonstrable.

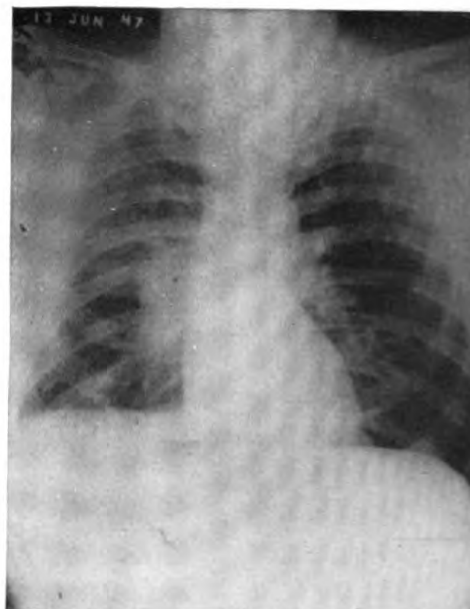


Figure 2.—Case 1. Roentgenogram taken 7 weeks after completion of treatment. There is residual pleuritis of the lower right hemithorax with flattening of the right diaphragm and partial obliteration of the costophrenic angle.

Thoracentesis in the eighth interspace posteriorly on the right resulted in the evacuation of 1,750 cubic centimeters of very thick, putrid, greenish-yellow pus. The empyema cavity was irrigated with normal saline solution and 200,000 units of aqueous penicillin were instilled. Direct smears showed gram-positive cocci and diplococci, but no growth was obtained on either aerobic or anaerobic cultures. Parenteral penicillin was continued in dosage of 50,000 units, intramuscularly, every 3 hours.

Thoracentesis, with normal saline irrigation and penicillin instillation, was repeated daily for 3 days and then every second or third day for a total of 10 such procedures. The individual dosage of penicillin instilled ranged from 200,000 to 600,000 units. Following the initial tap the pus became much less thick and by the third aspiration had become odorless and watery in consistency. The quantity of fluid obtained diminished with each succeeding drainage. A roentgenogram taken after the seventh such procedure showed marked clearing of the right hemithorax. Clinical improvement following the second thoracentesis was rapid and progressive. The patient was discharged from treatment 30 days after admission. Films of the chest taken 7 weeks later showed "minimal pleural thickening" (fig. 2).

Case 2.—A 60-year-old white male was admitted on 9 April 1947. He had been treated for a left lower lobar pneumonia in another hospital 2 months previously. Recovery from the pneumonia was said to have occurred within 2 weeks, but shortly after subsidence of fever, a left-sided pleural effusion had been diagnosed. According to the patient, straw-colored fluid was obtained by thoracentesis on two separate occasions. Two weeks prior to admission to this hospital, dependent

edema and orthopnea appeared. These symptoms responded to rest, digitalis and diuretics. The chief complaint on admission was dyspnea.

Physical examination revealed a fairly well-nourished male, moderately cyanotic and dyspneic. Rectal temperature was 101.0° F., pulse rate 94, and respiratory rate 30. Blood pressure was 122/70. There were physical signs of a large fluid collection in the left hemithorax.

Red blood cell count was 3,290,000 with 12 grams of hemoglobin. Total leukocyte count was 11,500 with a normal differential count. Roentgenographic examination showed a large pleural effusion on the left (fig. 3).

Shortly after admission the patient left his bed without permission and walked a few yards to the bathroom. He experienced a sudden sensation of severe substernal "tightness," with collapse, profuse sweating and increase in dyspnea. Temperature rose sharply in the next few hours to 102.4° F., the pulse rate to 154, and respiratory rate to 48. There was a concomitant leukocytosis of 22,200.

The patient was given morphine for pain and oxygen by tent. An electrocardiogram showed changes consistent with those of acute posterior myocardial infarction. (A subsequent electrocardiogram was not confirmatory.) Digitalis was continued and dicoumarol was started immediately.

Within 3 days the pain had subsided but dyspnea and cyanosis increased. Thoracentesis was performed in the eighth interspace posteriorly on the left and 1,000 cubic centimeters of thick, fibrinous pus were obtained. The odor was disagreeable but not putrid. The cavity was irrigated with normal saline and 600,000 units of aqueous penicillin were instilled. This procedure was repeated daily for 3 days and then every second day for a total of 7 thoracenteses. Only

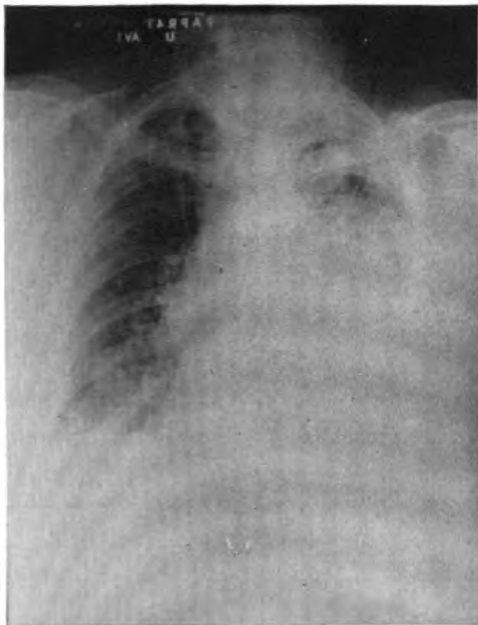


Figure 3.—Case 2. Roentgenogram taken prior to treatment. This reveals a homogeneous opacity in the lower two-thirds of the left hemithorax which is interpreted as a pleural effusion.

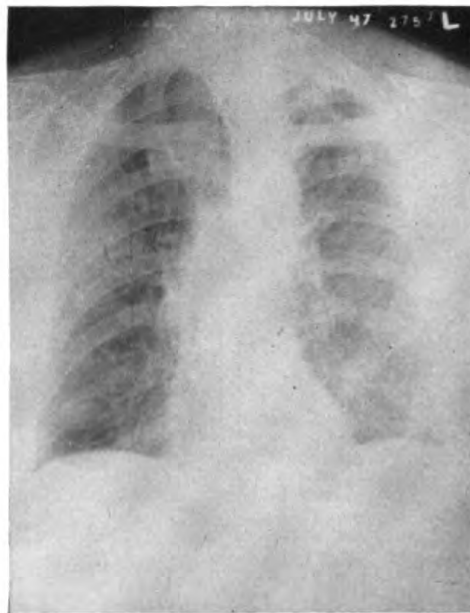


Figure 4.—Case 2. Roentgenogram taken 12 weeks after discharge from treatment. There is slight residual thickening of the pleura in the lower third of the left hemithorax. The left costophrenic angle is partially obliterated.

small amounts of thin, sanguino-purulent material were obtained on the last few occasions. Direct smear of the purulent material obtained at the first aspiration showed a few gram-positive cocci. *Staphylococcus albus* was the only organism cultured. In addition to its injection into the pleural cavity, penicillin was administered in dosage of 50,000 units, intramuscularly, every 3 hours throughout the course of treatment.

Following the second thoracentesis the temperature, pulse, and respiratory rate fell to normal and the patient improved steadily. Roentgenogram of the chest taken after the sixth thoracentesis showed clearing on the left but with some fluid still present.

During the latter phase of treatment a thrombophlebitis of the left leg became evident. This at an early or phlebothrombotic stage may have been the source of an embolus which would explain the acute, shocking, intrathoracic episode following admission.

The patient was discharged after 7 weeks of hospitalization. A follow-up roentgenogram taken on 21 July 1947 showing residual pleural thickening in the lower left hemithorax is reproduced (fig. 4).

COMMENT

These first 2 cases are representative of that considerable group of thoracic empyemas which will be cured by repeated thoracenteses with aspiration of pus and instillation of penicillin. In these cases which go on to ultimate cure, clinical response is dramatically rapid and progressive. We present our regimen of treatment as one which we have found satisfactory.

Once the location of the empyema cavity is established, a large (13 or 15 gage) needle is used for thoracentesis in order that thick pus may be aspirated without difficulty. Saline irrigations facilitate this. Large doses of penicillin (200,000 to 600,000 units) are instilled at the completion of drainage and irrigation. Penicillin is administered intramuscularly in more conservative dosage of 50,000 units every 3 hours, and discontinued from 4 to 7 days after the last thoracentesis, in the absence of indication for continued therapy.

Thoracenteses are performed daily at the onset of treatment. When a favorable clinical response has been obtained and the fluid aspirated has decreased markedly in amount and is negative to culture, the interval between taps is lengthened. Roentgenograms are taken at frequent intervals to establish that decrease in size of the empyema cavity and reexpansion of the lung are keeping pace with the other signs of improvement.

We regret the incompleteness of our bacteriologic data. We would recommend that the fluid removed be examined repeatedly by smear and culture at least until its sterility is established beyond doubt.

The response of the putrid empyema in case 1 is particularly noteworthy. In the past these cases were rightly treated as acute surgical emergencies. Aspiration was considered contraindicated because of the danger of spreading infection to the thoracic wall through the

needle tract. Penicillin has changed this. A few of the putrid empyema cases may be cured without operation by aspiration of pus and instillation of penicillin, and a still greater number may be greatly improved prior to surgical drainage (1) (5) (7) (16). However, morbidity and mortality still remain higher in the putrid empyema group than in the simple post-pneumonic empyemas.

At the time cases 1 and 2 were being treated on our wards we received, in 1 day, the following transfers from other hospitals. The treatment received prior to admission follows the same general pattern in all four patients.

CASE REPORTS

Case 3.—A 17-year-old white male was admitted on 5 May 1947. His illness had started approximately 3 months previously with pain in the right chest. This was accompanied by fever and chills. Sulfonamides and penicillin were administered. When a right-sided empyema was diagnosed, treatment consisted of "occasional" thoracenteses and instillation of penicillin into the pleural cavity.

On admission to this hospital the patient did not appear acutely ill. Temperature was 99° F., pulse rate 92, and respiratory rate 18. Emaciation was not marked. Positive physical findings were limited to the chest, where there was impaired resonance to percussion in the right axilla.

Blood count showed a mild anemia with a normal total and differential leukocyte count. Roentgenological examination revealed a poorly defined, slightly increased density in the right axillary region anteriorly. Thoracentesis was performed 2 inches lateral to the right nipple and 10 cubic centimeters of thin brown fluid were aspirated. An equal amount of air was injected to establish a



Figure 5.—*Case 3. Roentgenogram taken preoperatively. This reveals the small cavity in the right hemithorax containing fluid and the injected air.*

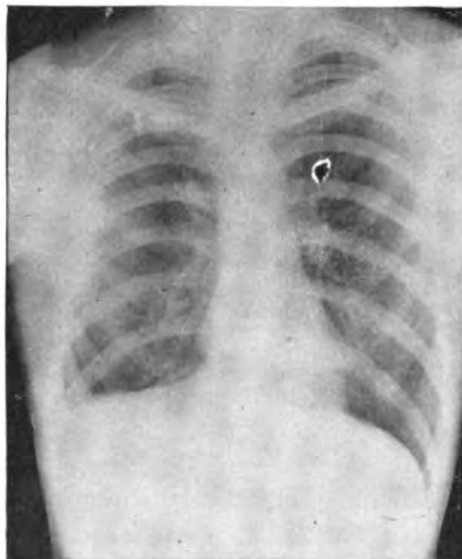


Figure 6.—*Case 3. Roentgenogram taken 5 weeks after operation. Slight residual pleural thickening is demonstrated.*

fluid level which would allow for more accurate roentgen diagnosis as to location, size, and character of the residual cavity (fig. 5). No organisms were seen on direct smear and no growth was obtained on culture of the fluid removed.

Thoracotomy was performed. Using 1 percent procaine for local anesthesia, a 2-inch section of the fifth rib was removed in the right mid-axilla. The small cavity was unroofed with escape of dark brownish fluid. Shaggy strands and clumps of fibrin were evacuated. A soft rubber tube was inserted for drainage and the cavity was packed loosely with gauze soaked in penicillin solution.

Approximately 3 weeks after operation, the cavity had contracted down around the tube, which was removed. Five weeks after operation, healing was complete. A final roentgenogram is reproduced (fig. 6).

Case 4.—A second 17-year-old white male was admitted on 5 May 1947. On 10 February 1947 the case had been diagnosed left lower lobar pneumonia, and 1 week later a diagnosis of complicating empyema was made. The patient had received penicillin intramuscularly and four thoracenteses had been performed prior to admission to this hospital. Amounts and character of fluid removed and dosages of penicillin injected intrapleurally are not known.

On admission, temperature was 100° F., pulse rate 120, and respiratory rate 18. The patient was not acutely ill, and the only positive physical findings were those of a large fluid collection in the left lower chest.

The red blood cell count and hemoglobin estimation were within normal limits. Total leukocyte count was 17,200 with an increase in percentage of polymorphonuclear neutrophils. Roentgen examination substantiated the clinical findings of a fluid collection in the lower left hemithorax (fig. 7). Thoracentesis was performed and thick pus was aspirated. No organisms were seen on direct smear. *Neisseria catarrhalis* was found on culture.



Figure 7.—Case 4. Preoperative film. The large fluid collection in the lower left hemithorax is obvious.

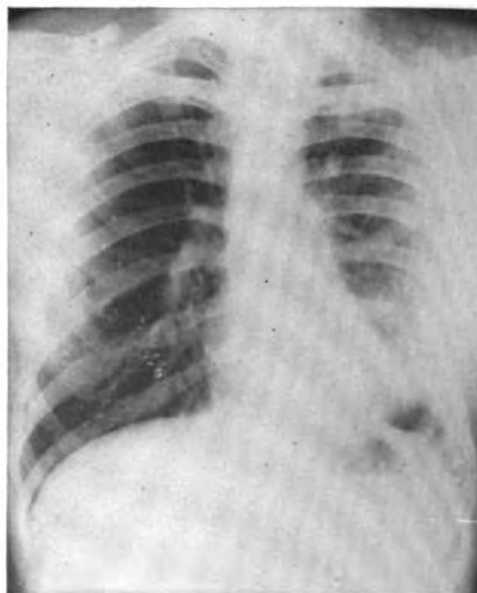


Figure 8.—Case 4. Roentgenogram taken 3 months after thoracotomy with drainage. There is considerable residual pleural thickening on the left. The heart is shifted to the left, the diaphragm is elevated, and the costophrenic angle is obliterated.

On 16 May thoracotomy was performed. Sections of the eighth and ninth ribs were removed in the posterior axillary line. A large quantity of thick, odorless pus was evacuated and open drainage was established. Pus obtained at operation showed no growth on culture.

Postoperatively the cavity was irrigated daily with penicillin solution, 500 units to the cubic centimeter. By 17 June the empyema cavity had contracted down to a capacity of 1 cubic centimeter as measured by instillation of the irrigating solution. The tube was removed. On 7 July the wound was apparently healed and the patient was given convalescent leave. On 20 July he returned from leave with slight drainage from his wound. The sinus tract was enlarged and a rubber dam drain was inserted. No definite intrapleural cavity was demonstrable. By 29 August the tract was again closed and has remained so to date (4 months). Roentgenogram taken before discharge to duty is shown (fig. 8).

Case 5.—This patient is a 19-year-old white male. On 1 March 1947 he developed left pleuritic pain and fever. The case was diagnosed left lower lobar pneu-

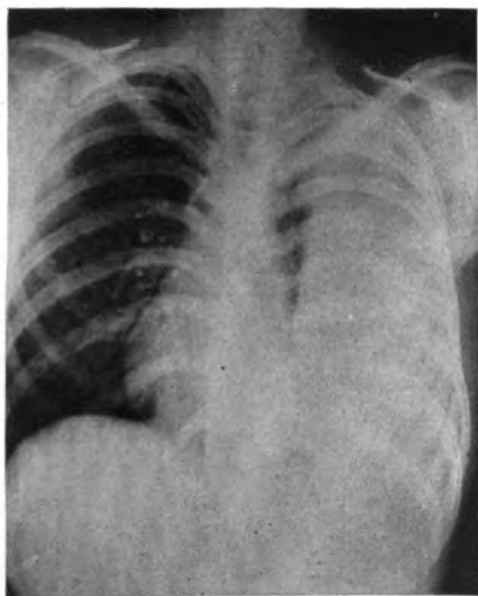


Figure 9.—*Case 5. Roentgenogram taken prior to operation. There is a massive fluid collection in the left hemithorax.*

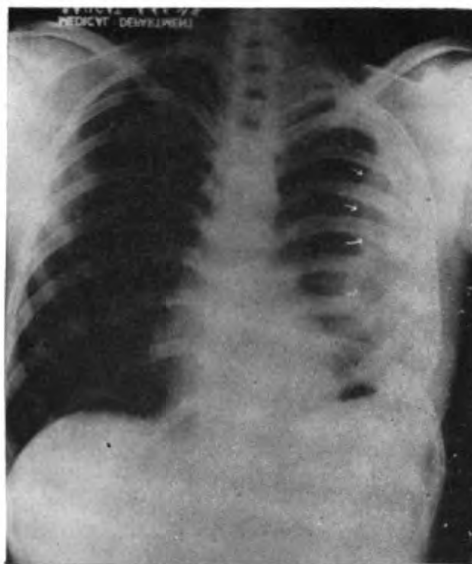


Figure 10.—*Case 5. This film shows the residual empyema cavity approximately 10 weeks after open drainage.*

monia and treated with sulfadiazine and penicillin. On 4 March thoracentesis was performed in the left posterior axillary line. Seventeen hundred cubic centimeters of pus were removed and 100,000 units of penicillin were instilled. Repeated thoracenteses were done at intervals of from 5 days to 2 weeks. Amounts of pus removed and dosages of penicillin injected are not known. The patient's only complaints on admission were weakness and loss of 45 pounds in weight.

Temperature was 97° F., pulse rate 96, and respiratory rate 18. The patient was emaciated and anemic in appearance. The left thoracic cage was retracted,

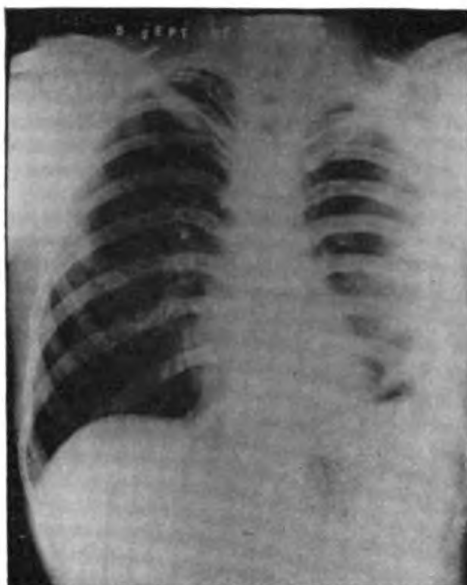


Figure 11.—Case 5. Roentgenogram showing obliteration of the residual empyema cavity following 3 weeks of suction drainage. Pleural thickening is marked.

with narrowing of the intercostal spaces. It scarcely moved with respiration. There was scoliosis of the dorsal spine with convexity to the right. The physical signs were those of massive pleural effusion, left chest.

Red blood cell count was 3,900,000 with 11.0 grams of hemoglobin. Total and differential leukocyte counts were normal. The roentgen diagnosis was "almost total empyema of the left hemithorax" (fig. 9). On 8 May thoracentesis was performed in the eighth interspace in the posterior axillary line. Five hundred cubic centimeters of thick yellow pus were aspirated. No organisms were seen on direct smear and no growth was obtained on culture.

Thoracostomy was performed. Sections of the ninth and tenth ribs were removed in the midaxillary line. About 1,000 cubic centimeters of pus were evacuated and open drainage was established.

Postoperatively the cavity was irrigated with penicillin solution and by 3 June its capacity had decreased to 315 cubic centimeters. In spite of breathing exercises and the use of blow bottles, subsequent decrease in the size of the cavity was slow. Roentgenogram taken on 8 August showed a good-sized residual cavitation (fig. 10) and on 12 August suction was applied. By 5 September the cavity had obliterated and the tube and suction had been removed. Roentgenogram taken on this date is reproduced (fig. 11).

Case 6.—The last of the patients admitted on 5 May 1947 was a white male, 18 years of age. The case had been diagnosed acute bronchitis on 1 January 1947, and the diagnosis was changed to primary atypical pneumonia, right, on 7 January. At this time the patient was critically ill and was receiving penicillin intramuscularly. On 11 January thoracentesis was performed on the right. Fourteen hundred cubic centimeters of pus were removed and penicillin was injected. Following this procedure the patient improved markedly. Several subsequent thoracenteses were performed at 1 to 2 week intervals and decreasing but still sizeable amounts of pus were evacuated. Dosages of penicillin intrapleurally are not known. For 6 weeks prior to admission to this hospital the patient was ambulatory, afebrile, and complained only of cough.

Admission temperature was 97° F., pulse rate 80, and respiratory rate 18. The patient was not acutely ill nor did he show much evidence of weight loss. Positive physical findings were confined to the chest. The right thoracic cage was slightly retracted and respiratory excursion here was limited. There were signs of pleural effusion on the right.

Red blood count was 3,850,000 with 12.5 grams of hemoglobin. The total and differential leukocyte counts were normal. The roentgenogram showed a pleural effusion in the right hemithorax, extending from the apex to the tenth rib in the posterior axillary line (fig. 12). Thoracentesis on 9 May yielded thick, greenish-

yellow pus. Direct smear was negative for organisms and no growth was found on culture.

On 14 May thoracostomy was performed. Two-inch segments were removed from the seventh and eighth ribs overlying the empyema cavity. About 300 cubic centimeters of thick pus were evacuated and open drainage was established.

Postoperatively the cavity was irrigated as in the preceding cases. Deep breathing and blow bottle exercises were practiced diligently. By 7 July the cavity still had a capacity of 100 cubic centimeters and it remained stationary at this size until 5 August (fig. 13). On 12 August suction was applied and was continued for 6 weeks. At the end of this period the cavity had closed down around the tube, which was removed. Healing was complete on 31 October. Roentgenogram taken at the time suction was removed is shown in figure 14.

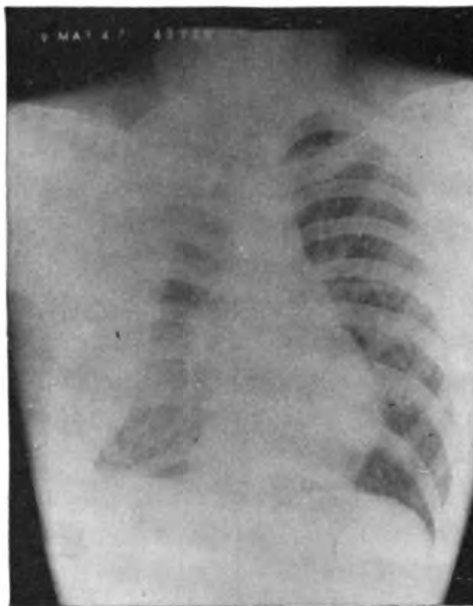


Figure 12.—Case 6. Roentgenogram taken prior to operation. The large pleural collection on the right is demonstrated.

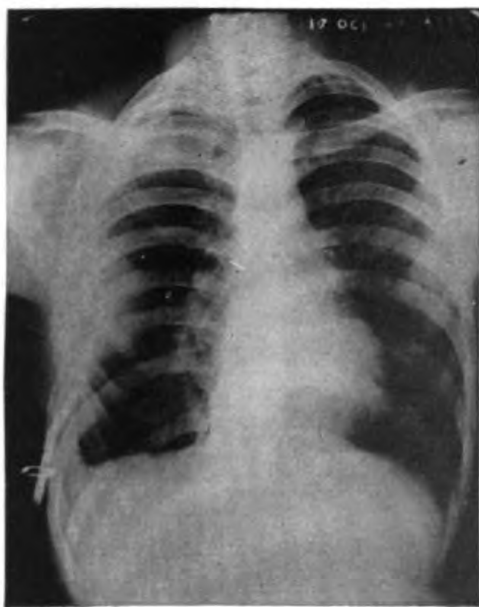


Figure 13.—Case 6. Roentgenogram taken approximately 3 months after thoracostomy with drainage. This shows the residual cavity with the drainage tube in situ.

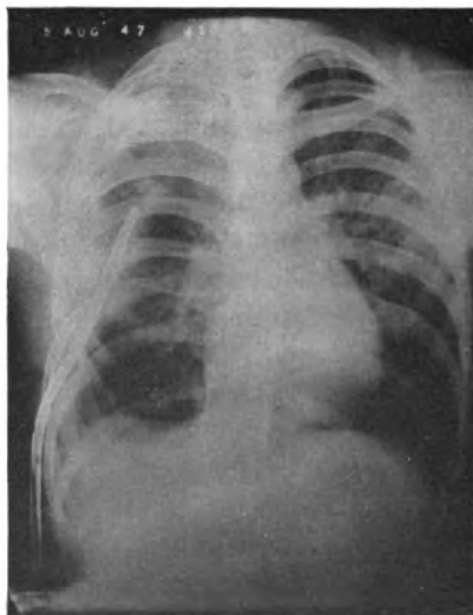


Figure 14.—Case 6. Roentgenogram after application of suction for 6 weeks. The cavity has obliterated but there remains considerable residual pleuritis. The short tube is in the sinus in the thoracic wall.

COMMENT

As best we can judge from the data available, the primary treatment regimen in these last four cases was inadequate; surely as to frequency of thoracentesis and possibly as to dosage of penicillin instilled. More disturbing than either of these considerations was persistence in conservative or nonoperative treatment in the face of the over-all picture which these patients presented on admission to this hospital.

There are two major objectives in the treatment of intrapleural supuration. The first is to control the infection and the second is to prevent residual changes which will result in decreased respiratory function. Of course it is desirable to reach these objectives as rapidly as possible.

In all four cases under discussion the first objective had been fairly well realized. None of the patients was acutely ill on admission. In three of the four cases temperatures were normal, as were the leukocyte counts. In none of the cases were we able to demonstrate the causative organism or organisms either by smear or culture of the empyema fluid.

The considerations involved in attaining our second objective are largely mechanical ones directed toward a rapid and complete reexpansion of the lung. If this is to be effected by thoracentesis without operation we would postulate that, in addition to becoming sterile, the purulent fluid must decrease rapidly and progressively in amount. It must not contain large aggregations of fibrin or sequestered lung which can not be aspirated. There must be no inaccessible loculations of fluid within the pleural cavity.

Three of the four transfers were admitted with large, sterile, undrained empyema cavities following 8 to 16 weeks of nonoperative treatment. Clearly our second objective was not being attained, probably because of failure to appreciate the limitations of the treatment being employed. The small residual cavity found in the fourth case might have obliterated without drainage. In view of the strands and clumps of fibrin found in it at operation and the prompt healing which followed evacuation, we feel that our operative procedure was justified.

The handling of these cases after we received them is open to criticism. Thoracotomy through an opening sufficient for exploration, breaking down of possible loculations, and evacuation of masses of fibrin or sequestra was certainly indicated in each instance. Decortication was considered. Although the empyemas had persisted past the optimum time for this procedure (17) (18) (19), good results from late decortication are being reported (20). When this procedure was passed over in favor of drainage and since no bronchopleural fistulae existed, suction should have been applied immediately. Un-

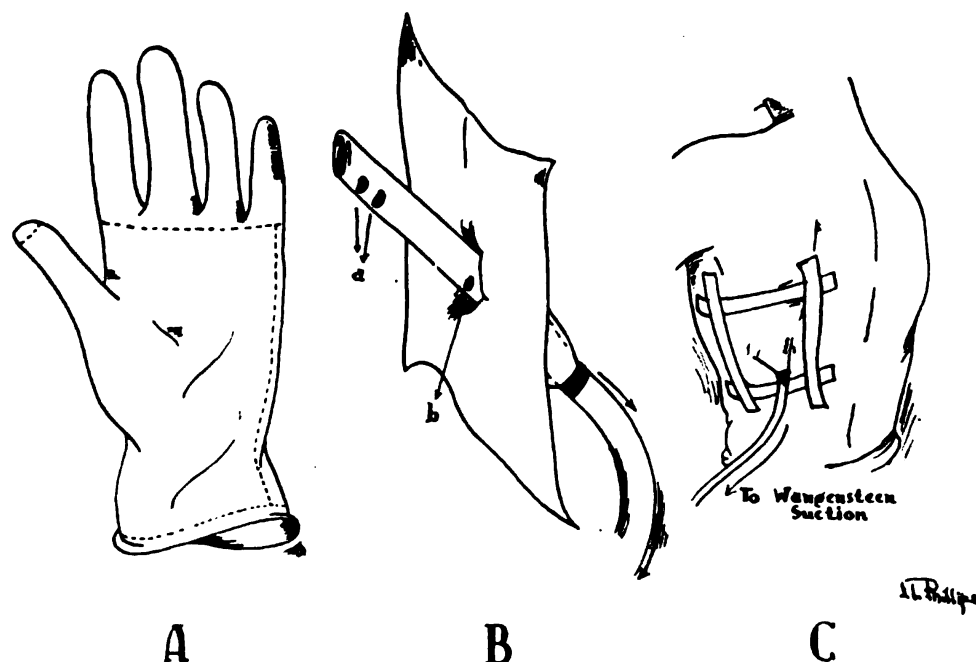


Figure 15.—Method of applying Wangenstein suction to an open thoracostomy wound (Johnson). A rubber surgical glove is cut along the dotted lines as indicated in A. A large drainage tube is tied into the thumb of the glove as illustrated in B. Drainage holes (a) lie within the empyema cavity. The hole (b) lies outside the chest wall but inside the thumb of the glove and is designed to carry off wound secretions which tend to accumulate and undermine the rubber dam. The rubber dam is secured to the chest wall with dermatome cement and adhesive tape as shown in C.

doubtedly this would have shortened the time required for obliteration of the cavity and the total period of hospitalization.

The method of converting an open drainage to a closed system with application of suction was suggested by Johnson (20) (fig. 15). This, of course, confines the patient to bed or at least to the close proximity of the Wangenstein suction apparatus. One of our surgical residents modified this arrangement to allow for periods of ambulation (fig. 16). With the bulb of a large asepto syringe collapsed, the nozzle is inserted tightly in the thoracostomy tube and the syringe is strapped to the chest wall. With release of the bulb, negative pressure is produced within the syringe and the communicating empyema cavity. As long as the system remains airtight the negative pressure is maintained. The patients attend the mess hall, the movies, and are granted short periods of liberty to return with the bulb still partially collapsed as evidence of the continued partial vacuum.

DISCUSSION

There are undoubtedly patients with acute empyema thoracis for whom it is difficult to determine exactly when nonoperative treatment

is failing and surgical intervention is indicated. However, from experience certain generalizations may be made. Those cases which are to respond favorably with a cure without operation usually do so rapidly. Toxemia disappears. Aspirated fluid becomes sterile and remains so, often following the first intrapleural injection of penicillin. In putrid empyemas the foul odor vanishes. The quantity of pus

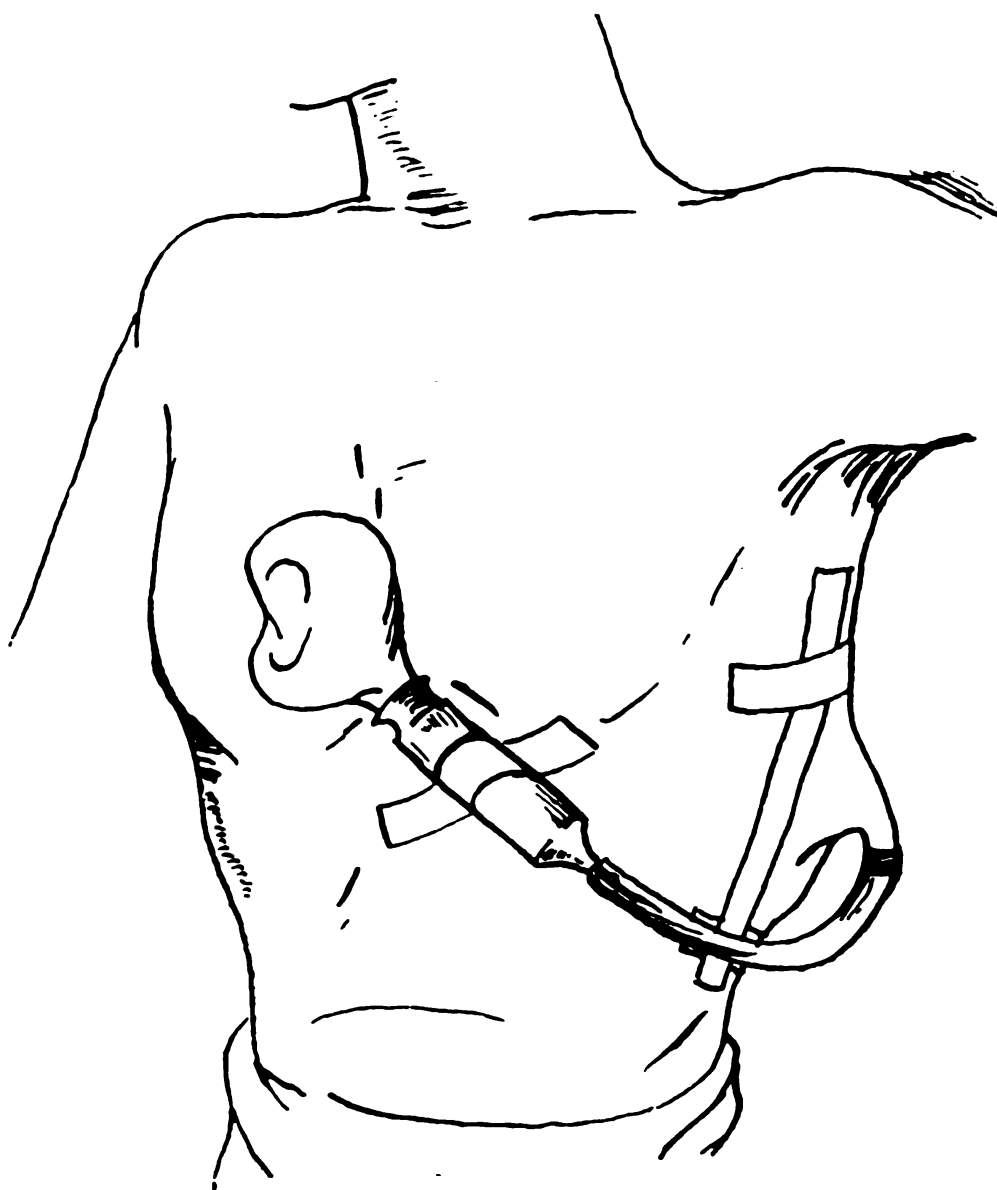


Figure 16.—A simple method of applying continuous suction to an empyema cavity in the ambulatory patient. The bulb on a new asepto syringe will maintain a negative pressure of approximately 80 to 90 centimeters of water.

diminishes with each succeeding aspiration and the lung expands correspondingly. Change in the character of the fluid is not constant.

At the end of a reasonable period of time, 1 to 2 weeks, if a case of acute empyema is not responding favorably as outlined above, one of several factors may be responsible. The therapeutic regimen may be inadequate. The causative organism may be penicillin-resistant. The empyema cavity may contain inaccessible loculations of pus. The cavity may contain masses of fibrin or necrotic lung which cannot be aspirated. A bronchopleural fistula may be present as a constant source of reinfection and to prevent proper reexpansion of the lung. In any event surgical intervention is indicated.

At this stage a choice of treatment is presented:

1. *Intercostal closed drainage*.—This method instituted after the toxemic phase has been controlled is reported as the procedure of choice by Fatti and coworkers (21) (22).

2. *Thoracostomy with rib resection*.—This is our choice over intercostal drainage. Sections of one or more ribs are removed to allow for adequate exploration and evaluation of the situation. Masses of fibrin or necrotic lung are evacuated, loculations are broken down, and dependent drainage is established. In the absence of a bronchopleural fistula, suction may be applied immediately, as illustrated.

3. *Decortication*.—This procedure is indicated particularly in total empyema with collapse of the apex (17) (19). At an early stage in the disease (up to 6 to 8 weeks) the operation is a relatively simple one. Functional restoration is rapid and in many instances complete.

When failure of the nonoperative treatment of a case of thoracic empyema is not recognized and accepted at an optimum stage for surgical intervention, there is a great loss of time and, even worse, possible sacrifice of ultimate function in effecting a cure. Decortication now becomes a more formidable procedure. The peel no longer separates readily and the underlying lung is frequently torn in its removal to produce multiple small bronchopleural fistulae. These and the fibrosis which may be present in the long-collapsed lung may make it impossible to obtain or maintain complete reexpansion of the lung.

Late drainage with suction may result in obliteration of the chronic empyema cavity but with marked pleural thickening and resultant thoracic deformity and crippling. Thoracoplasty may be necessary as a last resort.

SUMMARY

1. The curative value of the nonoperative treatment of acute empyema thoracis by repeated thoracenteses for aspiration of pus and instillation of penicillin is recognized. Two representative cases are presented.

2. Our therapeutic regimen is outlined.
3. The limitations of the nonsurgical treatment of thoracic empyema are stressed. Four cases are presented to illustrate the results of failure to appreciate these limitations.
4. Choice of surgical procedures for empyema thoracis is briefly discussed.
5. A simple method for maintaining relatively high degrees of suction on the empyema cavity in the ambulatory patient is described.

REFERENCES

1. BROWN, B.; ORY, E. M.; MEADS, M.; and FINLAND, M.: Penicillin treatment of empyema; report of 24 cases and review of literature. *Ann. Int. Med.* **24**: 343-370, Mar. 1946.
2. ORY, E. M.; JACKSON, G. G.; and FINLAND, M.: Gram-negative bacillus empyema cured by intrapleural penicillin. *J. A. M. A.* **131**: 1035-1038, July 27, 1946.
3. FINLAND, M.: Medical treatment of empyema. *Bull. New England M. Center* **8**: 1-5, Feb. 1946.
4. LOCKWOOD, J. S.; WHITE, W. L.; and MURPHY, F. D.: Use of penicillin in surgical infections. *Ann. Surg.* **120**: 311-349, Sept. 1944.
5. ORY, E. M.: Treatment of empyema with penicillin. *Am. Pract.* **1**: 23-26, Sept. 1946.
6. KULLMAN, H. J. F., and CRELLIN, J. A.: Penicillin in suppurative disease of lungs due to *Streptococcus hemolyticus*. *Ann. Int. Med.* **23**: 135-146, Aug. 1945.
7. RUDENSKY, H.; SPRONG, D. H., JR.; and WOODS, C. C.: Medical treatment of acute empyema; report of 5 cases cured with chemotherapy and thoracenteses. *J. A. M. A.* **128**: 573-577, June 23, 1945.
8. HEALY, M. J., JR., and KATZ, H. L.: Treatment of empyema thoracis with penicillin. *J. A. M. A.* **128**: 568-573, June 23, 1945.
9. PRINCE, G. E., and TEMPLE, W. J.: *Am. J. Dis. Child.* **74**: 447, Oct. 1947.
10. HIESHFELD, J. W.; BUGGS, C. W.; ABBOTT, W. E.; and PILLING, M. A.: Value of penicillin in treatment of empyema. *J. A. M. A.* **128**: 577-582, June 23, 1945.
11. LOCKWOOD, J. S.: Chemotherapy in surgery. *J. A. M. A.* **135**: 747-749, Nov. 22, 1947.
12. BLADES, B.: Penicillin as adjunct to surgical treatment of acute and chronic empyemas. *Ann. Surg.* **121**: 672-679, May 1945.
13. JACOBSON, J.: Penicillin in intrapleural infection. *U. S. Nav. M. Bull.* **46**: 97-102, Jan. 1946.
14. MCGRAW, A. B., and JACKSON, H. C.: Penicillin-sterile empyema. *U. S. Nav. M. Bull.* **46**: 1429-1438, Sept. 1946.
15. POPPE, J. K.: Limitations of penicillin in treating empyema. *J. A. M. A.* **129**: 435-438, Oct. 6, 1945.
16. STRIEDER, J. W., and LYNCH, J. P.: Putrid empyema. *New England J. Med.* **234**: 1-9, Jan. 3, 1946.
17. SANGER, P. W.: Decortication in acute empyema thoracis. *Surg., Gynec. & Obst.* **82**: 71-80, Jan. 1946.
18. KAY, E. B., and MEADE, R. H., JR.: War injuries of chest. *Surg., Gynec. & Obst.* **82**: 13-14, Jan. 1946.

19. BURFORD, T. H.; PARKER, E. F.; and SAMSON, P. C.: Early pulmonary decortication in treatment of post-traumatic empyema. *Ann. Surg.* **122**: 163–190, Aug. 1945.
20. JOHNSON, J.: Certain aspects of battle wounds of thoracic cavity, with special reference to method of facilitating re-expansion of lung following late decortication. *Surgery* **20**: 26–37, July 1946.
21. FATTI, L.; FLOREY, M. E.; JOULES, H.; HUMPHREY, J. H.; and SAKULA, J.: Acute infections of pleura treated with and without penicillin. *Lancet* **1**: 257–262, Feb. 23, 1946.
22. FATTI, L., et al.: Acutely infected pleural effusions; techniques of penicillin treatment. *Lancet* **1**: 295–300, Mar. 2, 1946.



DENTAL LOGISTICS IN AMPHIBIOUS OPERATIONS

FRANCES G. ULEN
Captain (DC) U. S. N.

THE prime requisite in planning any part of any naval operation is the determination of the objective to be achieved. The objective to be achieved by dental logistic planning is the determination of how dental support may be rendered to the combatant forces to such an extent that their battle efficiency will not be impaired.

Although this objective is so fundamental as to admit of no argument, at times there has been a tendency to lose sight of it in the desire to render the finest possible professional care to personnel who are immediately available for treatment, without giving due consideration to the needs of others. It is, of course, desirable to accomplish the best professional treatment possible at all times, and it should be the constant effort of all dental officers to do so insofar as the requirements of the naval service will permit.

From a strictly professional viewpoint it would be highly desirable that 100 percent of all dental treatment indicated for all naval personnel be completed and that this be accomplished by restorative dentistry of the highest possible quality. However, the function of the entire Medical Department of the Navy so aptly expressed by its slogan "To keep as many men at as many guns as many days as possible," carries with it a definite commitment to the greatest good for the greatest number of persons in combatant areas.

If dental logistic support is to be successfully achieved, it must insure the fact that insofar as dental conditions are concerned naval personnel at sea or in combatant areas are physically fit to fight and may be reasonably expected to remain so until rendered ineffective by reason of nondental causes or until returned to a noncombatant area.

In planning the dental phase of the logistic support to the combatant forces in any future naval operation, an analysis of the problems that were encountered in previous operations, an estimate as to the likelihood of their recurrence or of the occurrence of similar problems, and an exhaustive study as to what new and hitherto unknown factors may present themselves should be made.

Based on conclusions drawn from these three elements, ways and means may be devised to obviate the effects of anticipated difficulties or to cushion their impact to such an extent that the war effort will not be impeded. In consonance with this estimate of the basic principles of planning, an analysis has been made of the experiences of World War II, together with an estimate of the problems which may be expected to arise in future amphibious operations. Based on this analysis and estimate, measures to be employed to prevent these anticipated difficulties from materializing or to lessen their effect have been determined.

Prior to the opening phases of World War II some of our most able naval dental officers, skilled in war planning, were of the opinion that the problem of supplying adequate dental support to the combatant forces could be best met by the concentration of great numbers of dental officers at training facilities in order that recruits entering the naval service could be dentally rehabilitated prior to the completion of their training and their assignment to duty either afloat or in forward areas. Possibly the principal factors in arriving at this opinion were the knowledge that more and better dental treatment per dental operator is accomplished when large groups of dental officers are assigned to duty in well-equipped dental clinics under the supervision of a competent senior officer and the fact that this procedure is routinely and satisfactorily employed in time of peace.

Upon cursory examination this proposed wartime procedure of rehabilitating the teeth of recruits during their training period seems to be sound, and it is true that if it were practicable it would be ideal. However, it was tried and it did fail in that literally thousands of men were assigned to duty afloat or in areas of combat without having received adequate dental treatment. This was due in part to several changes in the basic factors upon which the amount of dental treatment to be accomplished in a given space of time had been established.

Dental standards for commission or enlistment in the naval establishment had been relatively fixed. The average amount of restorative dental treatment required per recruit had been constant and was known. The minimum period during which the recruit would remain at a training facility was not believed to be subject to any great change. However, these factors did change several times during the period of hostilities.

The tremendous demand for manpower coupled with the inability of the recruit to meet prescribed dental standards caused a relaxation of these standards. As the demand for manpower increased the dental requirements decreased until a standard was reached that in effect was no standard at all. Voluntary enlistment was replaced by induction.

The only dental requirement for induction was that the inductee's mouth be free of disease to such extent that his general health was not endangered. Under this procedure great numbers of edentulous persons entered the naval service. The situation was further complicated by the fact that the period during which recruits remained at a training center was progressively and appreciably reduced. The necessity for accomplishing the maximum amount of training during this brief time constantly prevented trainees from reporting to the dental clinics for badly needed treatment. As a result of these factors, comparatively few recruits received all dental treatment required prior to being assigned to duty aboard ship or in a forward area.

The seriousness of the situation which resulted is attested by a series of events which occurred in the southwest Pacific during the winter of 1944 and 1945 when the number of persons in the area of operation who were rendered ineffective by virtue of dental deficiencies assumed such magnitude as to seriously impede the war effort.

Literally thousands of men who were otherwise physically qualified were held in areas behind the line of combat by reason of dental disabilities. Moreover, the number of persons in the forward area who were completely ineffective from a military standpoint was increased by the addition of personnel required to mess, police, and otherwise care for these dental cripples. Eventually the situation became so grave as to cause the Commander of the Seventh Fleet to request by dispatch that no more persons be sent to the southwest Pacific until such time as they had been rendered dentally fit.

Since the facilities for rendering dental treatment in areas outside the continental limits of the United States were completely unable to meet the demand being made upon them, and in order that the repeated requests of the Commander of the Seventh Fleet might be complied with, it was directed that no persons should be ordered to duty aboard ship or to shore duty outside the continental limits of the United States until such time as all essential dental treatment had been completed for them.

Varying interpretations in the field as to what constituted essential dental treatment caused a series of directives to be issued to clarify this term. It was eventually defined as that dental treatment required to place the mouth and teeth of an individual in such condition of oral health that no further need for dental treatment could be reasonably anticipated in his case for a period of at least 6 months. These measures, aimed toward insuring an adequate number of fighting men in the area of combat who were in all ways physically fit to fight,

fell far short of achieving their objective. West coast ports of embarkation became increasingly congested with persons awaiting certification for overseas duty by a dental officer.

The ever present percentage of slackers hailed the required completion of essential dental treatment as a means of avoiding combat. In many cases this was accomplished by the deliberate sabotage of prosthetic dental appliances to avoid assignment to duty aboard ship or overseas. The situation deteriorated rapidly and was complicated by the presence of a tremendous number of men in the forward area who were assigned to duty in small craft to which dental officers were not attached. Dental service for personnel attached to such small craft, which should have been furnished by tenders, was either inadequate or totally lacking.

As the war progressed and the need for combatant personnel in the forward areas increased, it became apparent that even essential dental treatment could not be completed prior to the departure of such personnel from the continental limits of the United States. It became increasingly clear that the need for dental service in forward areas was of primary importance and was far greater than had been anticipated.

Various methods of meeting this greatly increased need were attempted. Although large, well-equipped Fleet dental clinics had been constructed in our overseas bases which had not fallen to the enemy, and were constructed progressively in areas from which he had been expelled, this procedure failed completely to alleviate the need for dental treatment in forward areas. These clinics were not completed until the advancing line of battle had left them hundreds of miles in the rear of the personnel whom they were intended to serve.

The need for dental service in capital ships and tenders, and to an extent in the small vessels served by these tenders, was met by the employment of multiple watches of dental officers assigned to duty in these ships and alternately using the same equipment during the period of their watch. Thus, in a three-operating-room dental clinic aboard ship nine dental officers could be employed working in three 6-hour watches. The procedure of using two and in certain cases three watches of dental officers proved to be generally satisfactory and was continued until the cessation of hostilities.

The problem of supplying adequate dental support in advanced areas was met in a large part, insofar as units of the Marine Corps were concerned, by the inclusion of a dental section in the Table of Organization of the Headquarters and Service Company of the Medical Battalion of the Marine Corps Division (1).

These dental sections provided for dental officers in the division in a ratio of 1 officer to each 500 men plus a proportionate number of enlisted dental technicians. This ratio included those regimental dental officers, dental officers attached to medical companies, and the enlisted assistants of these officers who had previously been provided for by the Tables of Organization of these components. Their designation as regimental and company dental personnel was not changed, however; they were under the general cognizance of the division dental officer who was also in direct charge of the dental section.

These sections were mobile field dental clinics, equipped to provide complete dental service and designed to move in whole or in part to any position within the division where they might be most effectively employed. Although supplied with the best material available, the field equipment of the dental sections was not entirely satisfactory in that it was heavy and cumbersome and was portable instead of mobile.

Generally speaking, the dental sections accomplished their mission in a very satisfactory manner. Their use was continued until the cessation of hostilities.

In establishing the Table of Organization of Construction Battalions, no allowance was made for the inclusion of dental personnel. This was done despite the fact that the greatest need for restorative dental treatment in any group in the entire naval service was that of the Construction Battalion. This condition was due, in part at least, to the average older age of the men forming these units plus their having been recruited from a group of civilian workers who do not regard restorative dental treatment as an essential.

Late in the war, tables of organization of construction battalions, regiments, and brigades were changed to include dental personnel.

The cessation of hostilities prior to the implementation of these changes precluded an accurate evaluation of the work that these officers and men would have accomplished had they had time to prove their value to their organizations. Their mission could have been and undoubtedly would have been as successfully accomplished as that of the dental personnel comprising the dental sections in the Marine divisions.

These efforts, aimed at supplying adequate dental support to personnel in the forward areas, were partially successful. Dental service in capital ships and tenders, in Marine Corps divisions, and in advanced bases not in the immediate combat area was greatly improved. Except for prosthetic dental treatment it may be regarded as having been generally satisfactory. The dental needs of personnel serving in practically all types of small craft and in many units ashore continued to be a problem until the close of the active period of the war.

Eventually it became apparent that the only true Fleet dental clinic capable of supplying dental support where it was most needed must

be a floating clinic capable of readily accompanying the vessels whose personnel it must serve. Numerous schemes were evolved in the forward area and many designs for the construction of such floating clinics were received in the Navy Department.

The most feasible of these was the suggested conversion of an LST to a Fleet dental clinic. This was to be accomplished by the installation of 10 dental operating rooms, an oral surgery, roentgenographic equipment, a prosthetic dental laboratory, storerooms and other accessory spaces plus quarters for the necessary dental personnel required to man the clinic. By the utilization of a two-watch system aboard these vessels for each such vessel placed in operation, the professional services of a total of at least 25 dental officers could have been made available where they were most needed.

Tentative approval for the construction of three floating clinics, similar to the one described, was secured prior to the close of the war, but plans for their actual construction were halted by the cessation of hostilities. The construction of these floating Fleet dental clinics would have cost no more in dollars, material, or effort than did the construction of Fleet dental clinics ashore which were left far in the rear of personnel to be served by the shifting area of combat. Had the floating clinics been available when they were most needed and had they been moved to the area where their services could have been best utilized, they would have aided materially in the prosecution of the war.

There is no cause to believe that active hostilities in any future war will be preceded by a long state of national emergency as was the condition before World War II nor by a period of strained relations similar to that which preceded our entry into World War I. We may find ourselves the subject of sudden and unexpected attack. There will probably be no time to prepare for war after the attack begins.

It may be reasonably anticipated that the conditions which prevailed in World War II will prevail again in any war in which the United States is engaged and in which her major effort is required. The great need for manpower will cause a virtual abandonment of dental standards for entrance into the naval service. The peacetime training period will be reduced. Dental rehabilitation of recruits during their training periods will not be satisfactorily accomplished.

The impracticability of accomplishing all dental treatment required by recruits during their period of training may be judged by a consideration of the dental status of 71,015 naval personnel at their first examination in 1942. This number was 4.61 percent of the average naval strength in 1942 and 1943. Any conclusions drawn from a consideration of such a large sample are particularly valuable.

The salient results of this survey were the determination that persons entering the naval service during the years 1942-43 averaged 10.13

carious cavities and that the naval dental officer repaired an average of 2,495.92 of these cavities per year. The average number of fillings placed does not include other dental treatment accomplished by dental officers. It is given here as a figure upon which an estimate of dental accomplishment may be based in that fillings constitute the greatest single treatment item.

From the foregoing figures it can be estimated that 1 dental officer could dentally rehabilitate approximately 20 recruits per month. This leads to the inevitable conclusion that complete rehabilitation cannot be accomplished during the training period by the number of dental officers available at training facilities.

In any future war the great majority of men will again be assigned to duty afloat or in combat areas in dire need of restorative dental treatment. It will be necessary to supply this treatment to the combatant personnel in the area of combat. Great numbers of persons in the naval service who have never before contemplated the necessity nor the desirability of dental treatment will demand such treatment either prior to or upon their arrival in an active theater. Their demands will not be ignored.

It is true that the peacetime dental requirements for entry into the armed forces of the United States have exceeded those of other nations and equally true that many individuals who demand dental treatment while in the service have done very well without such treatment in civilian life.

It has been argued that dental care for personnel of the armed forces is not sufficiently important to warrant the expenditure of material and funds required to provide treatment in combatant areas.

The opinion has been advanced that naval personnel should be assigned to duty regardless of their dental condition inasmuch as the combat efficiency of only a few of them would be impaired by dental deficiencies. Regardless of the truth of these statements, it still is of primary importance that adequate dental care be rendered to our combatant forces to circumvent criticism of the armed forces by the civilian population.

A war of any considerable duration to be successfully prosecuted by the United States must have the enthusiastic support of the citizenry. This support suffers in a direct ratio with criticism to the effect that the fighting man is being neglected. Cases in which the dental care of naval persons in combatant areas has been the subject of criticism have frequently been referred to the Navy Department by high Government officials with attendant embarrassment to the naval service. A true evaluation of the importance of dental care to combatant personnel may be arrived at when the necessity for popular support of the war is included in one's considerations.

The conclusion that any great war of the future will be attended by problems of dental logistic support similar to those encountered during World War II indicates that those measures which were satisfactorily employed in that war should be used again with such improvements in technique and material as may be indicated.

Plans for the dental support of future operations should include the accomplishment of as great a part of the required dental treatment as is possible during training periods plus the provision of dental service to combatant personnel afloat and in advanced areas sufficient to maintain such personnel dentally fit for combat. Maintenance of such combatant personnel in this condition will be partially achieved by the assignment of dental officers to duty in multiple watches in combatant vessels and in tenders, the use of dental sections in Marine Corps divisions, and by the provision of dental support to construction battalions, regiments, and brigades by means similar to those employed to provide such support to units of the Marine Corps.

In addition to the foregoing measures which were employed with varying degrees of success in the recent war, other measures are required to render satisfactory dental support to combatant personnel.

Field equipment for the use of dental personnel attached to Marine Corps and construction units must be improved to such an extent that it will be truly mobile and may be moved with rapidity and comparative ease by the individuals assigned to man it. The equipment of regimental and battalion dental personnel should include, and may well be limited to, that which can actually be manhandled by them and can be transported with them by any naval or military means which may be indicated. The equipment of dental sections, including prosthetic equipment, should be limited in size and weight to the greatest extent compatible with the provision of satisfactory dental service.

In view of the brief period of strained relations which may precede a future war, it is of paramount importance that measures be taken which will insure an adequate dental service to the expanding naval establishment immediately available upon mobilization. This in turn requires a reserve dental organization trained and available for immediate service. To aid in meeting this requirement the establishment for Reserve dental units has been authorized. These units should be procured and trained to such an extent that they will be capable of supplying a complete dental service and be immediately available for duty in such training facilities and at such dental clinics as may require their services.

The assignment of reserve dental personnel in this manner will help cushion the impact of mobilization by releasing officers of the regular establishment for assignment aboard ship, at advanced bases, and at

other activities where their experience as naval dental officers can be best utilized.

From the standpoint of the officers and men comprising Reserve dental units it would be desirable that they be maintained intact subsequent to mobilization. It can be safely anticipated that the exigencies of warfare will not permit this. This in no way detracts from the importance of having them available for the opening phases of a mobilization.

The Reserve dental unit should be a permanent organization but it is emphasized that its personnel must not be static. The availability of personnel should be checked at frequent intervals and should include physical examination to determine the capabilities of officers and men to discharge their duties.

Commanding officers and heads of departments who may qualify in all ways at the time of their original appointment may be less desirable in these billets after a passage of time. This may result from age, by change in the professional status of the individual, or for various other reasons. Dental officers in command of reserve units should be relieved after a reasonable period, thus permitting the assignment of a head of department or other qualified officer to command the unit. In a similar manner heads of departments should be relieved and be replaced, if possible, by officers who have served in their departments, and their places in turn filled by younger officers.

Such a procedure in the promotion of officers in conjunction with a comprehensive training program including instruction in those duties of a naval dental officer in contradistinction to the activity of a civilian dentist will obviate the assignment of officers who are inexperienced in naval procedure to billets as dental officers in command and to other positions of responsibility.

Training programs for units should be similar but sufficiently flexible to permit the utilization of training facilities and talents which may be peculiar to a single location. Courses of postgraduate instruction should be arranged for heads of departments in the specialty with which their department deals.

It is highly desirable that as specialty boards are set up by the American Dental Association, heads of departments of units be diplomates of these boards. At present, and probably for an appreciable period of time to come, such diplomates will not be available. This should not prevent other well qualified persons from being presently appointed as heads of departments.

Reserve dental units should be integrated into war plans and provision made for their employment within continental limits, in advanced areas and in floating dental clinics as required. Physical facilities for their use afloat and ashore should be planned for and available when required.

SUMMARY

1. Problems of dental logistic support similar to those encountered in the amphibious operation of World War II may be reasonably expected in future operations.

2. These problems may be successfully combated by the employment of measures which were previously effectively used plus certain additional measures.

3. Methods previously used which should be employed again include:

(a) Multiple watches of dental personnel aboard combatant vessels and tenders.

(b) Dental sections to be included in Tables of Organization of Marine Corps Divisions.

(c) Provision of dental service in construction units similar to the dental sections of Marine Corps divisions.

4. Additional methods which should be employed include:

(a) The development of field dental equipment capable of being readily and effectively moved by the personnel assigned to man it.

(b) The procurement of Reserve dental units to the number authorized, the training of these units and their integration into war plans.

(c) The determination of physical facilities required for the use of dental personnel of the Navy and the Naval Reserve, plus the timely provision of these facilities including floating Fleet dental clinics.

REFERENCES

1. ULEN, F. G.: Establishment of Dental Section in Medical Battalion of Marine Divisions of Fleet Marine Force. U. S. Nav. M. Bull. 42:581-583, Mar. 1944.
2. SCHLACK, C. A.; RESTABSKI, J. S.; and DOCHTERMAN, E. F.: Dental status of 71,015 naval personnel at first examination in 1942. J. Am. Dent. A. 33: 1141-1146, Sept. 1, 1946.



PERSISTING OCULAR DEFECTS IN PACIFIC WAR PRISONERS

EVERETT J. OLENICK
Commander (MC) U. S. N.

REPATRIATED American survivors of Japanese war imprisonment have been studied extensively by various observers and recovery from most of the effects of their mistreatment and starvation has been found to be fairly complete. From an evaluation of a representative sample of such prisoners who suffered ocular difficulties, however, it became apparent that a large proportion were permanently affected. Of 26 repatriates presenting persisting visual symptoms, who reached the ophthalmology service of this hospital,¹ the similarity of disability was found to be striking. Because such a group of cases probably will not again be available for study, barring national catastrophe, it is believed a report of the details observed will be of value.

THE PATIENTS

All 26 patients were repatriated white enlisted males who, as members of the prewar regular Navy and Marine Corps, had met rigid physical (and ocular) entrance standards. Their ages at capture ranged from 19 to 42 years, with a mean average of 24. Imprisonment had varied from 33 to 45 months during the period of 1942 to 1945, with a mean average of 41.7 months. Their diets had consisted of rice, water, thin soups, and, occasionally, fish. No fats were consumed except as contained in Red Cross packages, received on an average of twice a year. Subjected to unceasing arduous labor under relentless taskmasters, their physical well-being had been diligently neglected by their captors.

METHOD OF STUDY

A *history* was taken from each patient concerning the duration and location of imprisonment, nature of work assignments and living conditions, illnesses and injuries sustained (with special reference to the eyes), and treatment received during imprisonment and evacuation.

¹ From Ophthalmology Clinic, U. S. Naval Hospital, Great Lakes, Ill.

Visual acuity was carefully measured, and manifest or cycloplegic refractions were performed and repeated in efforts to raise this to the highest possible level. The eyes were then examined and re-examined as indicated with emphasis usually gravitating to corneal and fundus conditions as these assumed importance. General physical and laboratory examinations accompanied the special ocular procedures.

Visual fields were charted for their peripheral extent on the perimeter and for their central characteristics on the tangent screen. Fields for colors were examined in only occasional cases.

During the observation period treatment was individualized for each case but large doses of multiple vitamins were administered generally and were prescribed for use following discharge from the hospital. The period of hospitalization ranged from 1 to 7 months with a mean average of 4.1.

In addition to the original studies, examinations were repeated on three of the patients a year later, and on one of these, a second year later.

SUMMARY OF OBSERVATIONS

Table 1 lists the patients numerically in the sequence of their development of ocular symptoms and summarizes the individual histories. Table 2 notes the observed findings. The most notable occurrence was that of bilateral atrophy of the optic nerves, a condition which appeared in 19 of the 26 cases (73 percent of all). This atrophy was seen to be the predominant cause of the persisting visual loss which has been described variously as nutritional, postneuritic, or prison camp amblyopia. Other findings were as follows: Four cases of visual loss due to corneal opacity, one of which was associated with optic atrophy; two cases of correctible myopia, one of which was associated with lead neuritis; one case of central chorioretinitis; and one case of correctible hyperopic astigmatism.

HISTORY

A summary of the patients' histories disclosed that all had shared essentially the same experiences. Imprisonment was in the Philippines or Japanese home islands, except for patient 22 who was held on the Celebes where treatment was generally better and ocular disease less frequent. A history of corneal ulceration was obtained in 6 patients in half of whom it followed trauma from dust or explosive blast. In only 2 ulcer patients (cases 9 and 12, both nontraumatic) was optic atrophy diagnosed. This low proportion is at variance with the role of corneal ulcers in camp amblyopia as assigned by Bloom et al. (1) from a study of 33 soldiers. Beriberi (20 cases) and pellagra (16 cases) dominated the interim medical histories, with malaria, dengue, and previous syphilis being observed in 12, 8, and 3 cases respectively.

TABLE 1.—Medical histories of repatriated war prisoners with persisting visual deficiency

Case No.	Record No.	Months to onset	Age at capture	Beriberi	Pellagra	Previous syphilis	Malaria and dengue	Miscellaneous	Diagnosis
1	142517	3	19	X	X		M	Posttraumatic L. corneal ulcer	Opacity, cornea L.
2	141837	4	21	X	X		M	Brother of patient 14	Atrophy, optic nerve.
3	137251	4	21	X	X	X	M		Myopia.
4	137850	4	23	X	X				Atrophy, optic nerve.
5	133712	5	20	X	X				Do.
6	139632	6	20	X	X			Traumatic R. corneal ulcer, lead exposure.	Myopia, lead neuritis.
7	140041	6	20	X	X		M & D	Spontaneous L. corneal ulcer	Opacity, cornea L.
8	139428	6	21	X	X		M		Atrophy, optic nerve.
9	137497	6	22	X	X		(?)	Spontaneous L. corneal ulcer	Atrophy, optic nerve.
10	144649	6	38	X	X	X	M		Atrophy, optic nerve.
11	122104	6	42		X	X			Do.
12	138541	7	23	X	X				Do.
13	155246	8	20	(?)	(?)		(?)	Spontaneous bilateral corneal ulcers	Do.
14	144279	8	21	X	X		M	Brother of patient 2	Do.
15	137508	8	24	X	X		D		Do.
16	139638	10	21	X	X		M & D		Do.
17	141920	12	23	X	X		D		Do.
18	139519	12	23	X	X		M		Do.
19	137371	12	34	X	X		M		Do.
20	141330	15	41	X	X		M & D	Temporary blast blindness, 1942	Do.
21	167839	20	23						Astigmatism, hyperopic.
22	144598	36	36				M & D		Atrophy, optic nerve.
23	139630	Indef.	21	X			M		Do.
24	141961	Indef.	21	(?)	(?)		(?)		Chorioretinitis, central (R. E.).
25	(?)	Indef.	22	X	X		D	Postconcussion R. corneal ulcer	Opacity, cornea R.
26	170266	Indef.	32	X					Atrophy, optic nerve.

TABLE 2.—Observed findings in repatriated war prisoners with persisting visual deficiency

Case No.	Unaided acuity		Best correction		Fundi	Peripheral fields	Central fields	Diagnosis
	R. E.	L. E.	R. E.	L. E.				
1	20/15	8/20	20/15	13/20	L obscured	Not charted	Not charted	Opacity, cornea L.
2	8/20	6/20	8/20	6/20	Disk pale R&L. Macula mottled R&L.	Constricted 15° R&L.	Central and Paracent. abs. Scotoma R&L.	Atrophy, optic nerve.
3	1/40	2/20	20/20	20/20	Myopic	Normal	Normal	Myopia.
4	4/20	6/20	7/20	10/20	Disk pale R&L.	do	Central scotoma R&L.	Atrophy, optic nerve.
5	4/20	4/20	4/20	4/20	do	do	Paracent. abs. Scotoma R&L.	Do.
6	13/20	13/20	20/20	20/20	Sl. papillitis R&L.	do	Central scotoma R&L.	Myopia and lead neuritis.
7	20/20	2/20	20/20	2/20	Normal	Normal R. Constricted to 10° L.	Normal R. Constricted to 10° L.	Opacity, cornea L.
8	3/20	3/20	3/20	3/20	Disk pale R&L.	Constricted 15°-20° R&L.	Central abs. scotoma R&L.	Atrophy, optic nerve.
9	12/20	8/20	18/20	8/20	Disk pale L.	Constricted 30° R, 40° L.	Central rel. scotoma R. Not charted L.	Atrophy, optic nerve.
10	6/20	6/20	8/20	8/20	Disk pale R&L.	Constricted 20° temp. L.	Central and paracent. abs. Scot. R. Central abs. Scot. L.	Atrophy, optic nerve.
11	2/100	3/100	6/20	5/20	do	Constricted 20° R&L.	Small central abs. scotoma R&L.	Do.
12	10/20	13/20	16/20	16/20	Disk pale R.	Normal	Normal	Do.
13	13/20	4/20	13/20	8/20	do	Constricted 20° L.	Paracent. rel. scot. L.	Do.
14	7/20	7/20	7/20	7/20	do	Constricted 10° R&L.	Not charted	Do.
15	1/20	2/20	3/20	4/20	Disk pale R&L.	Constricted 10° R&L. Rel. cent. scot. R&L.	Paracent. abs. scot. R&L.	Do.
16	8/20	7/20	10/20	10/20	do	Constricted 20°-30° R. 10°-20° L.	Constricted to 30° R&L.	Do.
17	5/20	4/20	5/20	4/20	do	Constricted 20°-30° R&L.	Paracent. abs. scot. R&L. Rel. constriction to 15° R&L.	Do.
18	1/20	1/20	6/20	6/20	do	Normal	Paracent. abs. scot. R&L.	Do.
19	6/20	5/20	7/20	7/20	Disk pale R.	Constricted 10° R&L.	do	Do.
20	16/20	16/20	20/20	20/20	Normal	Normal	Paracent. abs. scot. R&L. Central rel. scot. R&L.	Astigmatism, hyperopic.
21	5/20	1/20	5/20	1/20	Disk pale R&L. Macula mottled L.	Constricted 20°-25° R&L.	Paracent. scot. R&L.	Atrophy, optic nerve.
22	14/20	6/20	14/20	10/20	Disk pale R&L.	Constricted 10° R&L.	Normal	Do.
23	2/20	2/20	2/20	2/20	do	Constricted 20° R&L.	Central scotoma to 8° R&L.	Do.
24	8/20	20/20	12/20	20/20	Central chorioretinitis R.	Normal	Central abs. scotoma R.	Chorioretinitis, central R.E.
25	2/20	20/20	2/20	20/20	Normal	Constricted to 40° R.	Constricted to 15° R.	Opacity, cornea R.
26	9/100	1/20	10/20	10/20	Disk pale R&L.	Normal	Paracent. abs. scot. R&L. Enlarged blind spot R.	Atrophy, optic nerve.

Diarrhea or dysentery had affected all the patients on one or more occasions while hookworm, skin ulcers, and various tropical diseases had occurred sporadically. The history in the optic atrophy cases was that of rapid development once the condition began. Some men were attacked and others spared without apparent reason. Cecha (4), who observed the development of such cases while himself a prisoner of war, was impressed by the factor of individual susceptibility. Physically small men appeared to him to be more immune to nutritional amblyopia than their taller, more robust confreres, and he felt that the loss of vision was reversible only if recognized and treated early by rest and improved fare.

VISUAL ACUITY

Unaided visual acuity in the involved eyes ranged from 2/100 to 16/20 as noted in table 1. In the optic atrophy group of 19 cases, the eyes were affected bilaterally without exception. Improvement following treatment and refractions was slight or nonexistent in most of these, maximum benefits being 4/20 except in one astigmatic myope (case 26) whose improvement was 9/20. In the nonatrophic cases, the degree of correctibility was determined by the underlying abnormality in each.

FUNDUS FINDINGS

Pallor of the optic disks, either complete or temporal, was present bilaterally with greater or lesser intensity in 20 of the patients including all those with optic atrophy. This proportion may be open to question, however, because of the known relative lightness of the temporal part of the papilla. In contradistinction to the sharp margins of primary atrophy, the disk margins were generally somewhat indistinct. Recognizable mottling of the macular area was noted in two of the patients with nerve atrophy (cases 2 and 21) and papillitis from lead exposure in one (case 6). One fundus (case 24) showed macular chorioretinitis.

VISUAL FIELDS

Peripheral.—With perimetric field studies using a 5-mm. white test object at 330 mm. distance, generalized constriction of from 10° to 40° was found bilaterally in 12 cases and unilaterally in 4. All but seven of the optic atrophy cases showed bilateral involvement and two of these exhibited unilateral constriction. Although red and blue color fields were charted with insufficient constancy for accurate numerical tabulation they were not disproportionate. McDaniel et al. (2) had reported the ability to recognize color at the periphery of vision to be particularly impaired in their group of war prisoners but the present series indicated only the progressive diminution normally present

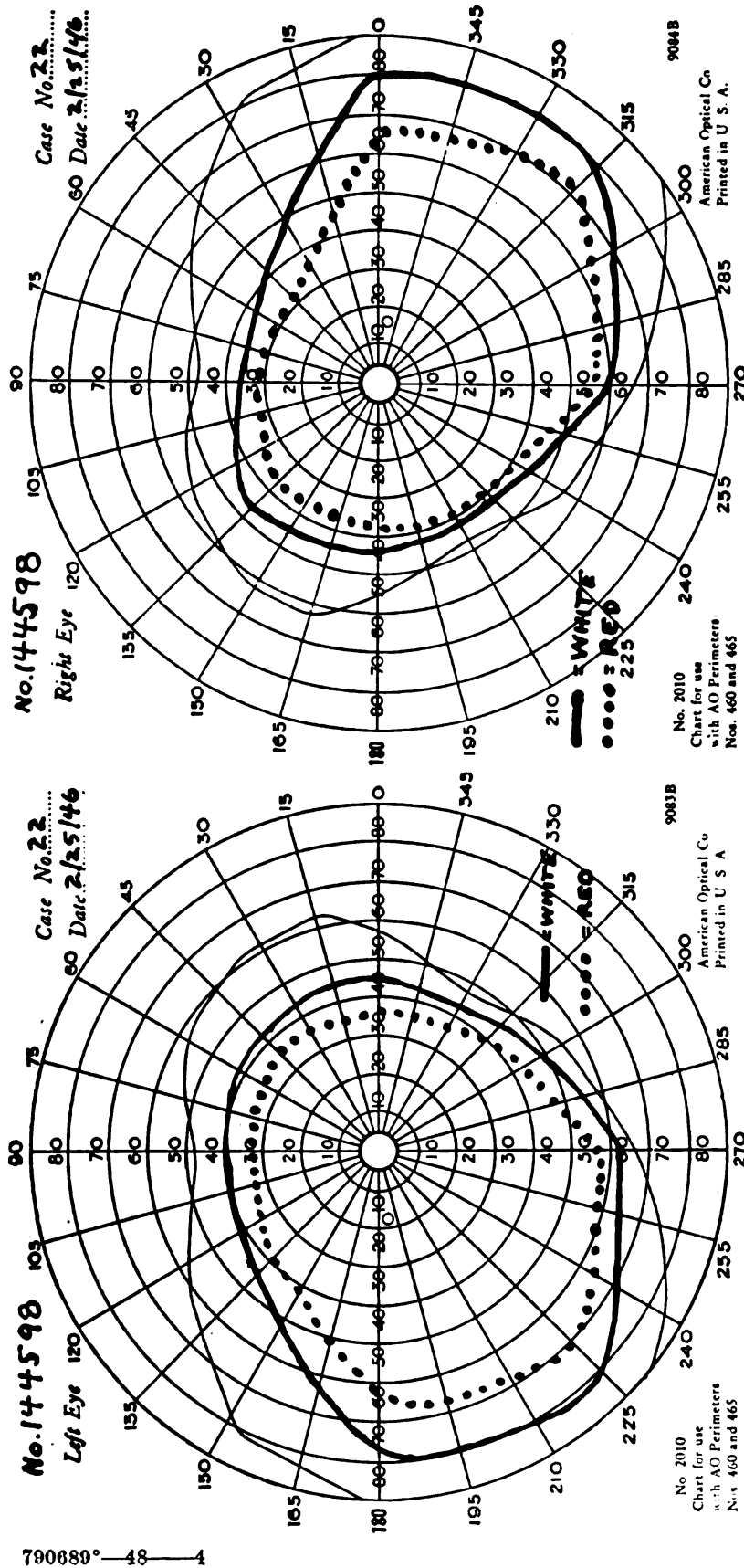


Figure 1.—Peripheral fields for white and red. Case 22.

TANGENT CURTAIN RECORD CHART

NAME 170266

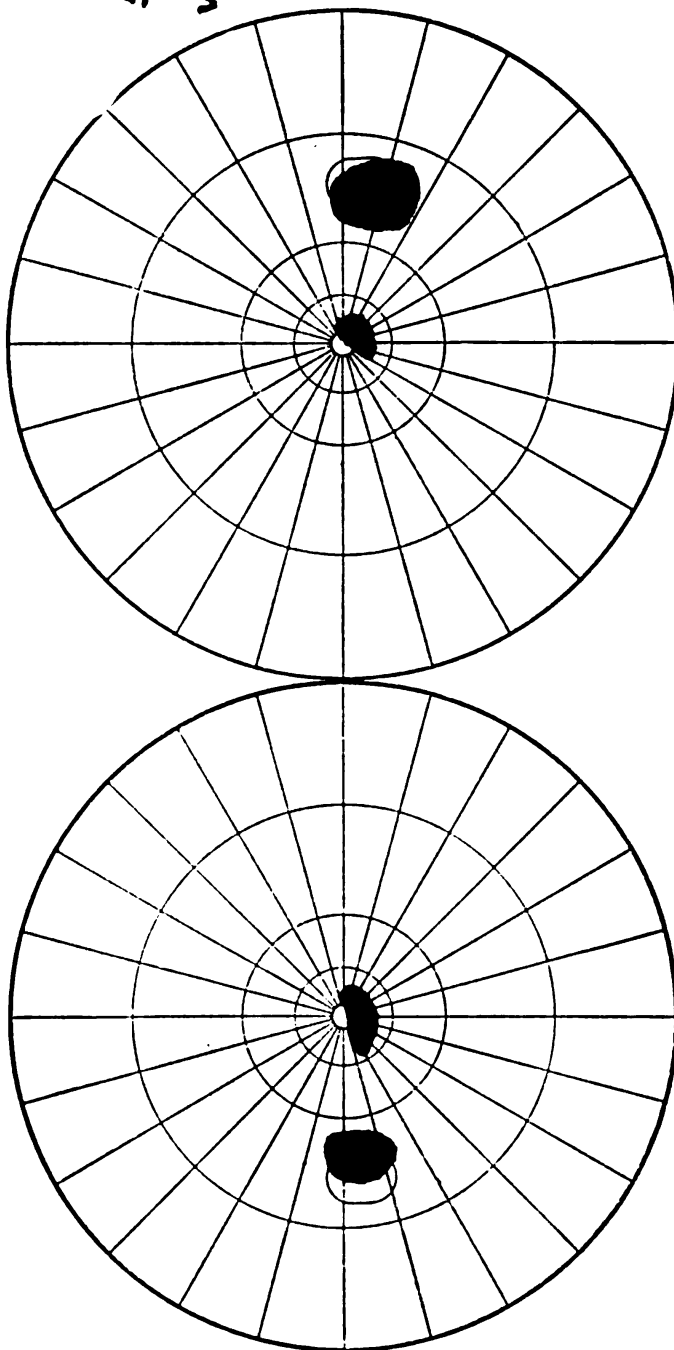
AGE 36

DATE 12/6/46

DIAGNOSIS

L. EYE

R. EYE

TEST
OBJECTS5/1000
WHITETEST
OBJECTS5/1000
WHITE

PERIMETRIST

Ego

NTC01-0-7-45-NH-1M

Figure 2.—Central fields, showing scotomata. Case 26.

between white, blue, and red fields (3). This normal relationship held true even in the optic atrophy group of which figure 1 is a representative chart.

Central.—Central field studies were made with a white test object 2 mm. or larger against a tangent curtain 1 meter from the patient. In 19 of the 24 cases charted, absolute or relative central and/or paracentral scotomata were disclosed as shown in figure 2. All but 4 of these occurred among the 19 cases of atrophy and of the 4, 1 showed constricted central fields, 2 were normal, and 1 was not charted. Enlargement of the blind spot was suggested in a few fields but the amount was not appreciable.

OBSERVATIONS FOLLOWING LATE REEXAMINATION

Three patients (cases 11, 19, and 22) returned a year following the initial examination for comparison studies. Each stated that his vision had improved appreciably. Their ability to read large newspaper and to play cards was demonstrated, but when visual acuity was measured on the standard Navy printed chart it was found essentially unchanged. Two of the patients showed uniocular loss of 1/20 and the third a gain of 1/20. The field studies were almost identical with the original charts even as to the size and location of central scotomata. The subjective improvement therefore seemed to have resulted mainly through more efficient utilization of remaining intact visual elements. Patient No. 22 returned again after a second year, but the findings were still unchanged. He reported being able to perform hydrographic chart work satisfactorily by using a binocular loupe.

COMMENT AND SUMMARY

Of 26 sailors and marines who suffered visual damage while prisoners of the Japanese, many will remain permanent ocular cripples. Nineteen of these were partially blinded because of optic nerve atrophy believed due to postinflammatory degeneration of the nerves following the action of endogenous toxins associated with avitaminosis (5). Because of the high incidence of beriberi and pellagra among the optic atrophy patients, the depletion of vitamin B complex appears important in the etiology. The exclusively carbohydrate diet doubtlessly intensified the deficiency because of the utilization of vitamin B in carbohydrate metabolism (6).

Bilateral affection was found without exception among the cases of optic atrophy. In patients with only a single eye impaired, other etiology became obvious at once. Although some of the patients had suffered neuritis of the peripheral nerves concomitantly with their optic neuritis during imprisonment, the former quickly proceeded to recovery. The susceptibility of the optic nerves to lasting damage is

thus reaffirmed as a sign of their close relationship to the brain from whose foreportion they develop embryologically.

The excessive and unceasing physical labor program is believed to have accentuated the metabolic deficiency as suggested by the absence of cases among officers who, though sharing identical diets with the enlisted personnel, were not assigned to labor details. Indoor workers were similarly spared to a greater degree than outdoor workers.

Individuals seemed to vary in susceptibility to starvation neuritis and physically small men appeared relatively better able to withstand the hardships of imprisonment. Two patients with optic atrophy (cases 2 and 14) were brothers.

Corneal ulceration was a very infrequent precursor of optic atrophy in this series, and color fields seemed to retain normal comparative relationships.

Once firmly established, nutritional optic atrophy is seen to be non-reversible. The subjective improvement claimed by some patients is considered to have occurred mainly at the cerebral level. Prevention, for the most part, could have been so easy.

REFERENCES

1. BLOOM, S. M.; MERZ, E. H.; and TAYLOR, W. W.: Nutritional amblyopia in American prisoners of war liberated from the Japanese. *Am. J. Ophth.* **29**: 1248-1257, Oct. 1946.
2. McDANIEL, F. L.; WHITE, B. V.; and THOMPSON, C. M.: Malnutrition in repatriated prisoners of war. *U. S. Nav. M. Bull.* **46**: 793-810, June 1946.
3. TRAQUAIR, H. M.: *Introduction to Clinical Perimetry*. Henry Kimpton, London, 1946. p. 12.
4. CECHA, A. H.: Personal communication, 1948.
5. DUKE-ELDER, W. S.: *Textbook of Ophthalmology; Volume 3—Diseases of the Inner Eye*. C. V. Mosby Co., St. Louis, Mo., 1940. p. 3007.
6. WOHL, M. G. (editor): *Dietotherapy: Clinical Application of Modern Nutrition*. W. B. Saunders Co., Philadelphia, Pa., 1945. p. 55.



SIX ATYPICAL CASES OF SYPHILIS

JAMES F. MORRELL

Lieutenant, junior grade (MC) U. S. N.

IT IS the purpose of this paper to review some atypical cases of early syphilis which have proved difficult of diagnosis. Each of these cases was confused with some other disease before the diagnosis was established and three were admitted to some other service before being transferred to the dermatology service. Various treatments were given and operations performed which delayed the diagnosis, made the true diagnosis less evident, and exposed the physician and the contacts of the patient to the dangers of syphilitic infection.

CASE REPORTS

Case 1.—W. R., a 23-year-old colored male, was admitted to the surgical service on 26 December 1947 with a diagnosis of cellulitis of the right thumb. A week prior to admission the patient had developed a sore at the base of the right thumbnail which became progressively larger despite local therapy in the form of magnesium sulfate soaks. A lymphangitis developed and extended up the right forearm. There was no history of trauma to the thumb prior to development of the lesion.

On admission the physical examination revealed that the significant findings were confined to the right hand and right forearm. On the right thumb, just proximal to the nail was an erythematous, edematous, dark-colored, foul-smelling lesion. There was a swollen, tender streak on the right forearm but the lymph nodes were not enlarged. The temperature and respiration were normal, the pulse was slightly elevated. Penicillin, 50,000 units every 3 hours, and hot soaks were ordered. On routine laboratory workup the urine was negative; the white blood count was elevated to 14,400, and the differential showed 54 polymorphonuclears and 46 mononuclears. The Kahn was reported as 4 plus 4 days after admission. A darkfield was ordered immediately. By this time the patient had received about 1,600,000 units of penicillin, and the darkfield was negative. The lesion was healing slowly and on 6 January the patient was seen by one of the dermatology staff who suggested a diagnosis of extragenital chancre. The patient was then transferred to the dermatology service. At this time he had completed 6,600,000 units of penicillin.

Further inquiry into the history revealed that the patient did not experience any fever, nausea, joint pains or malaise after the first few injections of penicillin. He had had a negative Kahn on being discharged from the Army in June 1947, and there was no history of any penile lesion or generalized eruption since that time. Examination revealed a healing ulcer on the dorsum of the right thumb and moderate enlargement of one lymph node in the right axilla.

Another Kahn was reported as 4 plus and the diagnosis was accordingly changed from cellulitis of the right thumb to early syphilis. It is felt that this lesion was a chancre although no positive darkfield was obtained.

The patient was retained in the hospital until he had received 8,000,000 units of penicillin and then was discharged and referred to the Board of Health. At this time the ulcer had epithelialized over and was healing satisfactorily.

DISCUSSION

A review of this case indicates that the physicians who first saw this man did not entertain the thought of syphilis and incidentally exposed themselves to possible infection. Purely by chance the patient was placed on the proper treatment, but had a sulfonamide been used the lesion would probably have healed in a routine manner with the true diagnosis delayed. Only by the chance of a routine blood Kahn was the diagnosis made at all. Had this lesion healed under inadequate therapy there would follow the dangers of relapsing secondary syphilis as a public health problem and late syphilis as an individual problem. The rapidity with which penicillin sterilizes these lesions makes the diagnosis much more difficult in treated cases.

Case 2.—R. B., a 22-year-old colored male, was admitted to the dental service on 6 January 1948 with a diagnosis of right submandibular abscess with cervical adenitis. The patient gave a history of having been kicked in the jaw about 2 months before admission. This was followed 3 weeks later by a submaxillary swelling with simultaneous occurrence of a painless ulcer on the right side of the lower lip. He was seen at a general hospital where x-rays were taken for fracture of the mandible but the x-rays were negative. He then went to a private physician who incised the mass but no pus was obtained. There was no pain or tenderness associated with this mass until it was incised. The incision had almost healed by the time he came to us.



Figure 1.—Case 2.

Examination revealed a nontender, partially crusted ulcer at the mucocutaneous junction of the right side of the lower lip. There was a rubbery induration in the lip deep under the ulcer. A mucous patch was noted on the right tonsil but no other mucous membrane lesions were seen. A markedly enlarged, firm, nontender lymph node was found below the right ramus of the mandible with a fresh scar overlying the node. The anterior cervical chain on the right side was enlarged, firm, nontender, and the individual nodes were not discrete to palpation. No secondary eruption or penile lesions were found.

The patient was first seen by one of the dental officers, who made a diagnosis of early syphilis and referred him to the dermatology service. *Treponema pallidum* was found in the lip lesion and also in the large submandibular lymph node. The Kahn was 4 plus; other laboratory procedures were not remarkable. Eight million units of penicillin were given, and the lesion regressed rapidly under treatment. No local or systemic Herxheimer reaction was noted.

DISCUSSION

This case represents a fairly common and typical extragenital chancre, which nevertheless was seen and misdiagnosed by at least three physicians before the correct diagnosis was made.

The patient was at large for about 6 weeks with a highly infectious type of syphilitic lesion for which he had sought relief. Responsibility in this case devolves entirely upon the medical men whose suspicions were not aroused by the remarkably clear-cut findings which this man presented.

Case 3.—S. M., a 59-year-old white male, was admitted to this hospital on 6 January 1948 with a provisional diagnosis of measles.

His illness had started about 1 month before admission when he developed two so-called pimples on his chin. These grew slowly in size to about 1.0 cm. in breadth and 0.5 cm. in height. They became ulcerated and were irritated by shaving but were not otherwise painful. About 2 weeks before admission he developed a sore throat, some huskiness of his voice, and a mild frontoparietal headache. On the day before admission a generalized rash appeared which did not itch. In the clinic the rash was thought to be morbilliform in character and the patient was admitted to the contagious ward.

On the ward physical examination revealed two ulcerated nodules on the chin and a generalized eruption of ham-colored papules about 3 mm. in diameter, infiltrated and non-pruritic. These papules did not appear on the face, palms, or soles. However there were many similar moist, eroded papules on the penis and scrotum. A moderately enlarged, firm, nontender lymph node was noted at the left angle of the mandible. The pharynx was markedly injected, but no mucous patches were noted.

The examining physician immediately suspected syphilis and asked one of us to see the patient. We concurred in the diagnosis and a darkfield was immediately done on the chin lesions but no treponemes were found. The following morning, however, the base of one of these chin lesions was aspirated with a small needle and *Treponema pallidum* was found. The patient was then transferred to the dermatology service and penicillin treatment was started. That evening, after the third injection of penicillin, the patient developed a local Herxheimer reaction consisting mainly of laryngeal edema. This was controlled by the administration of epinephrine and Benadryl. Penicillin was temporarily discontinued. The following morning penicillin was started again and continued without incident. Under treatment the rash faded, the two eroded nodules dried up and regressed, the sore throat was relieved, and the headache disappeared.

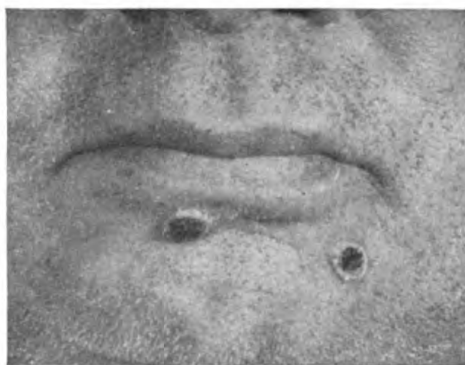


Figure 2.—Case 3.

The patient completed 8,000,000 units of penicillin and was discharged to the Board of Health.

DISCUSSION

There are several interesting points about this case. The nodular chin lesions, antedating the general eruption by about 4 weeks, and containing *Treponema pallidum*, may be regarded as primary lesions. They do not resemble any chancres that we have seen previously, but they fulfill the criteria of syphilitic primary lesions. This case emphasizes the point that any dubious lesion should have a darkfield examination.

The age of the patient is also misleading. One does not ordinarily see 59-year-old men with early syphilis, but we must not let such a factor interfere with our diagnostic suspicion.

Case 4.—B. S., a 20-year white male, was admitted to this hospital on 8 January 1948. He was seen in the dermatology clinic and admitted to the hospital with a provisional diagnosis of early syphilis.



Figure 3.—Case 4.

About 3 weeks before admission he had noticed some swollen glands beneath his jaw and a chapped lower lip. He went to his family physician who advised warm magnesium sulfate soaks to be applied to his jaw. The swollen glands did not decrease in size, while the chapped lip developed into a definite ulcer. At this stage the ulcer, although painless, seemed daily to increase in size. A mercurochrome-acetone mixture was used locally, but to no avail. After about 3 weeks the possibility of syphilis was considered. Because the attending physician felt that the patient

would still have a negative blood test, it was arranged to have a blood test done on the patient's girl friend. This girl's blood was found to be 4 plus, and the patient was then sent to this hospital for diagnosis and treatment.

The patient stated that at no time had he noticed any sores on the mouth of this girl, and he denied any oral sexual contact.

Examination revealed a firm, somewhat tender, rubbery, deeply infiltrated ulcer at the midpoint of the lower lip. The lesion was about 3 by 4 cm. in size and caused the lower lip to project and hang down, making it appear about four times its normal size. The submandibular lymph nodes were enlarged, with the largest single node on the left side near the angle. There was no history or visual evidence of any penile sore.

Repeated darkfield examinations of serum from the surface of the lesion, serum aspirated from the base, and fluid aspirated from the lymph node all were negative for *Treponema pallidum*. The Kahn, however, was 4 plus, and therapy was started with penicillin.

After the first three injections of penicillin a local Herxheimer reaction was noted in the form of swelling of the lower lip. According to the patient the lip

became twice the size it had been previously. However, by the following morning the lesion was again as we had seen it on admission.

Under treatment the lesion regressed rapidly so that on discharge there was only a slight deformity of the lower lip. He was referred back to his family physician for disposition.

DISCUSSION

This case illustrates again the apparent unfamiliarity of the practitioner with the extragenital manifestations of early syphilis and his low index of suspicion for the disease. A progressively enlarging, painless ulcer of the lip, associated with marked regional lymphadenopathy should suggest syphilis very early in the course of the disease.

This is one of the few cases of untreated early syphilis in which we have been unable to recover *Treponema pallidum* from the lesions. The presence of secondary infection and local medication are the greatest deterrents to successful darkfield examination. In this case both these factors were present and probably account for the failure. If such a lesion is found to be negative to darkfield examination, saline soaks may be used for a day or so in order to prepare the lesion for further examination.

Case 5.—C. H., a 23-year-old white male, was admitted to the hospital on 29 January 1948. In January 1947 he had developed a penile sore. His blood test proved to be positive and antisyphilitic treatment was given from January to August 1947, at which time his blood test was negative and treatment was discontinued. He was told to come back every few months for check-up blood tests. In December 1947 he developed a painless sore in the middle of his upper lip. Shortly thereafter he went for his check-up blood test at one of the mid-



Figure 4.—Case 5.

Two days after taking penicillin tablets and one day after an arsenical injection, he was admitted to this hospital. Four darkfield examinations of serum from the lesion and one darkfield of fluid aspirated from the base failed to reveal *Treponema pallidum*. His blood Kahn, was 4 plus, and treatment was started.

Physical examination revealed only an ulcer at the mucocutaneous border of the upper lip, with some tenderness and marked induration in the tissue under the ulcer. The submandibular lymph nodes were not enlarged at this time, but

the patient stated that he had noticed some lumps there about 4 weeks previously. No penile sores or secondary lesions were present.

This apparent reinfection had been contracted during the fall of 1947. It was the patient's wont to pick up strange girls at dances and escort them home. He did not remember kissing any girls with sores about their lips. Actual sexual contact was apparently not the source of infection in this case.

DISCUSSION

It is unfortunate that this man should have been allowed to go about for 11½ months with a lesion such as this without having anything done for him. It is the fault of the profession, not of the patient, that he was at large with this infectious lesion on his lip. Despite the lack of a positive darkfield there is little doubt that the lesion was a chancre. It showed immediate improvement under penicillin therapy and was almost healed on discharge from the hospital.

Case 6.—J. McG., a 17-year-old white male, was submitted to the hospital in March 1948 with a diagnosis of early syphilis. On 8 January of this year, while riding on a bus, he had struck up an acquaintance with a girl and had kissed her. He noticed at the time that she had a small sore on her lip but he did not think anything of it. Four weeks later, while in the brig because of a minor offense, he noticed the appearance of a small ulcer on his lower lip. He called it to the attention of the hospital corpsman on duty, who told him that it was a



Figure 5.—Case 6.

canker sore and that it would go away. On leaving the brig he again went on leave and he in turn kissed three girls while he was home. During this leave he developed another ulcer on his upper lip opposite the original one. Shortly after the appearance of the second ulcer, he developed some lumps beneath his chin. These were not tender and did not bother him particularly. Returning from leave he reported to the sick bay at the receiving station because the ulcer on his lip was not healing. Syphilis was suspected immediately and a Kahn was done which was reported as 4 plus.

He was transferred to this hospital for treatment.

On admission there was noted a crusted indurated ulcer in the center of the lower lip. It was nontender, clean, and about 1 cm. in diameter. On the upper lip was a smaller, less indurated ulcer. When the lips were closed, the two ulcers were in apposition. The submandibular lymph nodes were enlarged bilaterally with the largest single node on the left side. No other nodes were palpable and there was no secondary syphilitic eruption or any evidence of a penile lesion. Two darkfields of the lip lesions were negative, but many *Treponemata pallida* were found in fluid aspirated from one of the submandibular nodes. The Kahn was found to be 4 plus. Treatment was started with penicillin and on the first evening he had a rise in temperature associated with joint aches and malaise. On the second day the submandibular nodes became more prominent but were still not painful. The two ulcers began to regress in size and heal over. On the seventh day the patient awoke to find his lower lip

swollen. It was not sore or inflamed and this was thought to be a transient affair. On the next morning the lip was still more swollen, and on close inspection the regional lymph nodes were thought to be more enlarged than before. Subsequently this edema subsided and the lip lesion went on to heal uneventfully.

DISCUSSION

This case illustrates again the innocuous appearance of the early lip chancre. Even the tremendous regional lymph node enlargement failed to arouse in this man any suspicion that there was anything the matter with him. This is also a graphic demonstration of the more or less innocent transmission of syphilis, that is, by kissing instead of intercourse.

The sudden and unexplained appearance of edema of the lip on the seventh day corresponds with the exacerbation of secondary lesions 6 to 10 days after onset of treatment noted by Thomas and his associates (1). This may be the same type of so-called delayed Herxheimer reaction.

At this time we do not have any follow-up information on either the possible source of the man's infection or on the girls who were kissed by him after he had developed his chancre.

COMMENT

MacClatchie (2) reported a series of extragenital chancres in service personnel. Diagnosis in his cases was also obscured by the premature administration of penicillin necessitating some delay before the diagnosis could be confirmed by serologic test.

According to most authorities an overwhelming proportion of extragenital chancres occur about the mouth. The reason for this is the frequency of mouth to mouth contacts, and the highly infectious character of the lesions in this area. Primary lesions frequently, however, occur in such sites as the finger, nipples, and anus, and rarely in such bizarre sites as the eyelid (3) and the ear (4).

Wile and Holman (5) noted in their series of cases a marked preponderance of lip chancres, with the tonsil and the digits next in order of frequency. They found that their cases were either venereally associated in origin or no adequate origin at all could be traced.

There were accordingly no proved instances of intermediate infection through inanimate objects in this series of 68 cases, illustrating the rarity of this mode of infection. The authors also emphasized the failure of early diagnosis of syphilitic manifestations in unusual locations.

CONCLUSIONS

1. In general, chancres appearing in atypical locations are not readily diagnosed. This is due in part not only to the innocuous ap-

pearance of the lesions but in a large part to the low index of suspicion on the part of individual physicians.

2. Before ordering penicillin on patients with acute ulcers of unknown etiology, the physician should ask himself whether a darkfield could be done on the lesion. More promptness in doing darkfields and less haste in ordering penicillin would result in the early diagnosis of many more extragenital chancres.

3. Any ulcer resisting local treatment for more than 3 weeks should be suspected of being a chancre if the exact etiology has not already been proved.

4. Patients who suddenly develop malaise, joint aches, and rise in temperature after the administration of penicillin for pyogenic infections should be carefully investigated for syphilitic infection. Such Herxheimer effects rarely occur except in conjunction with syphilis.

REFERENCES

1. THOMAS, E. W. : LANDY, S. : and COOPER, C. : Reactions to penicillin therapy for syphilis. *J. Invest. Dermat.* **10**: 77, Feb. 1948.
2. MACCLATCHIE, L. K. : Extragenital primary syphilis. *U. S. Nav. M. Bull.* **47**: 970-974, Nov.-Dec. 1947.
3. STOKES, J. H. : *Modern Clinical Syphilology*. 2d edition. W. B. Saunders Co., Philadelphia, Pa., 1934. p. 573.
4. RIPA, A. S., and BARTLETT, A. G. : Extragenital chancre of ear. *Arch. Dermat. & Syph.* **58**: 264, Aug. 1947.
5. WILE, U. J., and HOLMAN, H. H. : Survey of 68 cases of extragenital chancres. *Am. J. Syph., Gonorr., & Ven. Dis.* **25**: 58-66, Jan. 1941.



NEUROPSYCHIATRIC SCREENING OF A MILLION MEN

ELBERT C. REITZEL

Captain (MC) U. S. N. R.

VERNON L. MILLER

Commander H(S) U. S. N. R.

GEORGE W. KNOX

Lieutenant Commander H(S) U. S. N. R.

THE FUNCTION OF THE NEUROPSYCHIATRIC CLINIC AT A NAVAL TRAINING CENTER

IT IS the function of the neuropsychiatric clinic at a naval training center to weed out, during the original training period, those mentally unfit for Navy life. The result is a more efficient personnel entering Navy routine from "boot camp," and a minimum of maladjusted, unhappy individuals.

Those "mentally unfit for Navy life" include all recruits having any mental, neurological, or psychosomatic difficulties which are of such severity that the individual will be more of a detriment than an asset to the Navy. Those rejected are not necessarily mentally unfit for a less rigorous civilian life.

The psychiatrist or psychologist assigned to such duty is apt to find himself between two opposing viewpoints. It is well that he adopt a "middle-of-the-road" attitude, and continually bear in mind his fundamental objective: "To reject only those who, in his opinion, would be more of a detriment than an asset; and to accept only those who, in his opinion, will be more of an asset than a detriment."

The opposing viewpoints, mentioned above, are quite natural results of human nature working under different environmental circumstances and under different motivating conditions.

The job of the recruiting station on the one hand, during voluntary enlistment, is to "sell the Navy to prospective sailors," so that the Navy will be able to meet its personnel requirements. When the percentage of rejections runs high at the training center, the recruiting officer is likely to feel that some of his efforts have been in vain.

On the other hand, when the percentage of rejections runs low, those whose job it is to train efficiently an unorganized group into a smooth-running, well-organized company in a relatively short time are apt to feel that they are being handicapped by certain recruits who are a little slower in learning, or who are having some trouble in adjusting to their new mode of life.

In addition to the two mentioned examples, other individuals may lean toward one or the other viewpoint and may tend to exert pressure on the psychiatrist and psychologist. The family and people in the home town, the draft board, even those in government positions representing the areas from which the recruits are coming, may feel that certain individuals should or should not be in the service, or that the percentage of rejection is either too high or too low. Then, of course, the recruit exerts his influence. Some recruits will, either consciously or subconsciously, develop almost any psychosomatic symptoms in order to be discharged, while others will beg to stay in service, in spite of known neuropsychiatric or psychological handicaps.

If the psychiatrist and psychologist are consistent in following the above formula (to reject only those who would be more of a detriment than an asset, and to accept only those who would be more of an asset than a detriment), and if there is a variation in the quality of the incoming recruits, then one would expect a corresponding fluctuation in the percentage of rejections.

It is the purpose of the present article to present a monthly percentage of rejections throughout an approximate 5-year period, involving the examination of over a million men, and to analyze the possible relationship between the rise and fall of the percentage rejected and the factors which might cause corresponding variations in the quality of incoming recruits. In addition, since psychiatrists and psychologists are human, and therefore subject to variations in judgment, the records may show some variations in the percentage of rejections which are due in part to the attitude and techniques of those making the judgments, rather than to the variations in the quality of recruits.

THE PROCEDURE OF DETERMINING THOSE UNFIT FOR NAVY LIFE

When recruits report to the training station a brief psychiatric and psychological examination is included as a part of the general medical examination. Those who evidence serious neuropsychiatric difficulties are referred directly, as "admits," to the neuropsychiatric clinic. The less serious cases, who indicate possibilities of inability to adjust to Navy life for neuropsychiatric or psychological reasons, are given a 3-week period of trial duty. This period is the same as for other

recruits, with the exception that at the end of the period the company commander writes a report describing his opinion of the recruit's adjustment to Navy life. This report is sent to the neuropsychiatric clinic and the recruit is interviewed at the clinic. Depending upon (*a*) the nature of this report, (*b*) the seriousness of the neuropsychiatric or psychological condition, and (*c*) the recruit's motivation and subjective experiences, he is (*a*) admitted as a patient, (*b*) given a further 3-week period of trial duty, or (*c*) released to full duty.

In addition to the company commander, any officer dealing with the recruit's training, the chaplain, or a medical officer in another clinic, can refer the recruit to the neuropsychiatric clinic for examination. The recruit may also report to the neuropsychiatric clinic voluntarily if he feels he is having difficulty in adjustment. All of these referrals are dealt with in the same way as the trial duty cases.

When a recruit is admitted to the clinic as a patient, he is (*a*) given more thorough neuropsychiatric and psychological examinations by the psychiatrist and psychologist; (*b*) is interviewed by the Red Cross psychiatric social worker (attached to the clinic) in an effort to adjust various personal and family problems; and (*c*) if any organic brain involvement, brain injury, or convulsive disorder is suggested, an electroencephalographic examination is made of all brain areas.

When all of the data are gathered, the recruit appears before the "aptitude board," consisting of a minimum of one psychiatrist, one psychologist, one Red Cross representative, one medical officer, and one line officer who deals with recruit training. All aspects of the case are then considered together—his intelligence, his psychosomatic and neuropsychiatric condition, his company commander's report of trial duty, and the recruit's own motivation and wishes. Consideration of the latter factors may be interpreted from an altruistic standpoint; however, experience has shown the recruit's motivation to be just as important as the other factors in determining his aptitude for the service. On the basis of all of these factors the aptitude board then decides whether the recruit shall be discharged by reason of unsuitability or shall continue in the naval service.

ANALYSIS OF FACTORS DETERMINING PERCENTAGE DISCHARGES

Figure 1 shows the number of recruits given psychiatric and psychological screening examinations at the U. S. Naval Training Center, Great Lakes, each month from April 1942 through December 1947. Months are indicated by the first letter of the name of the month. Figure 2 shows the percentage admitted to the neuropsychiatric clinic and the percentage discharged as unsuitable for naval service, during the same period.

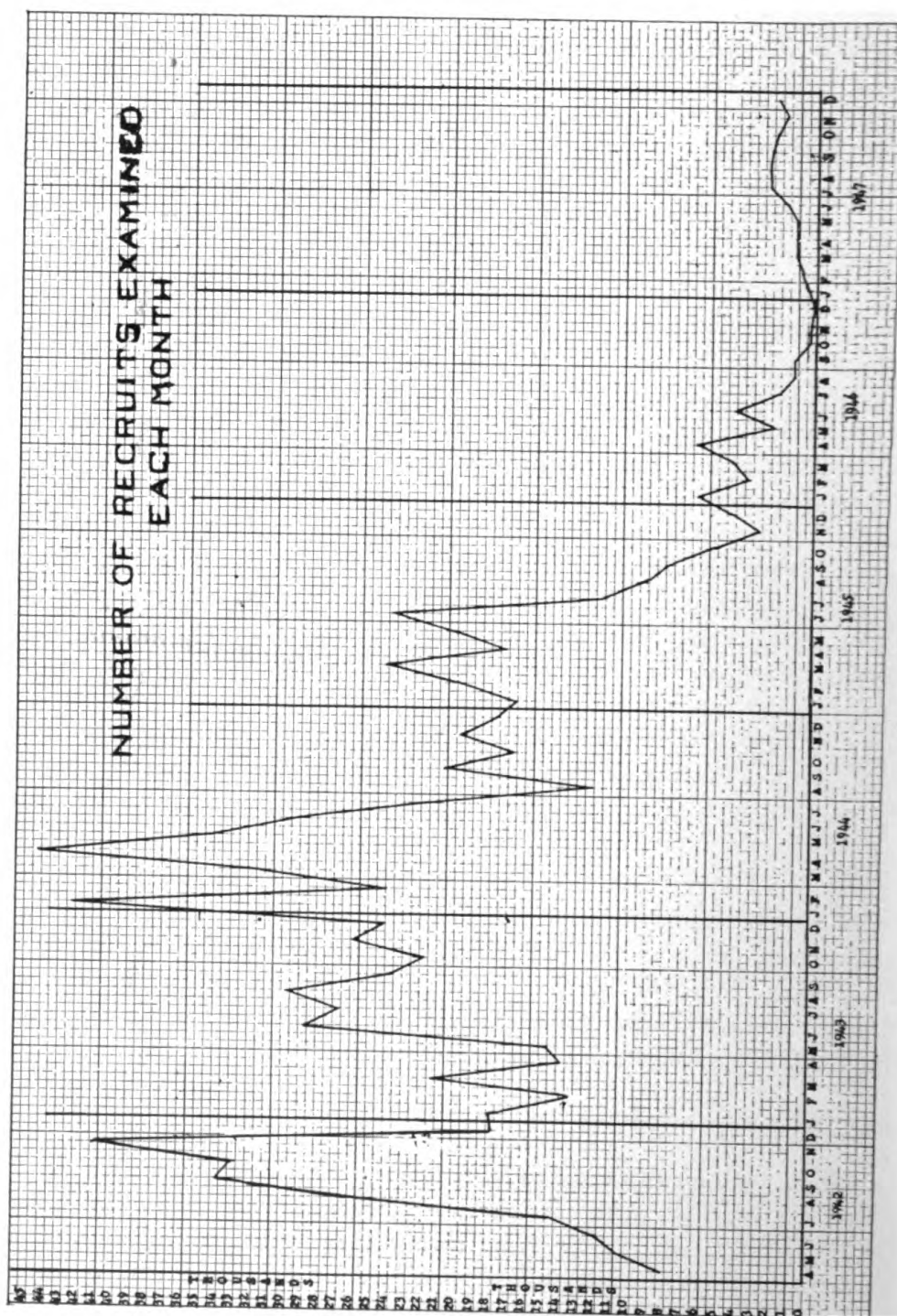


Figure 1.

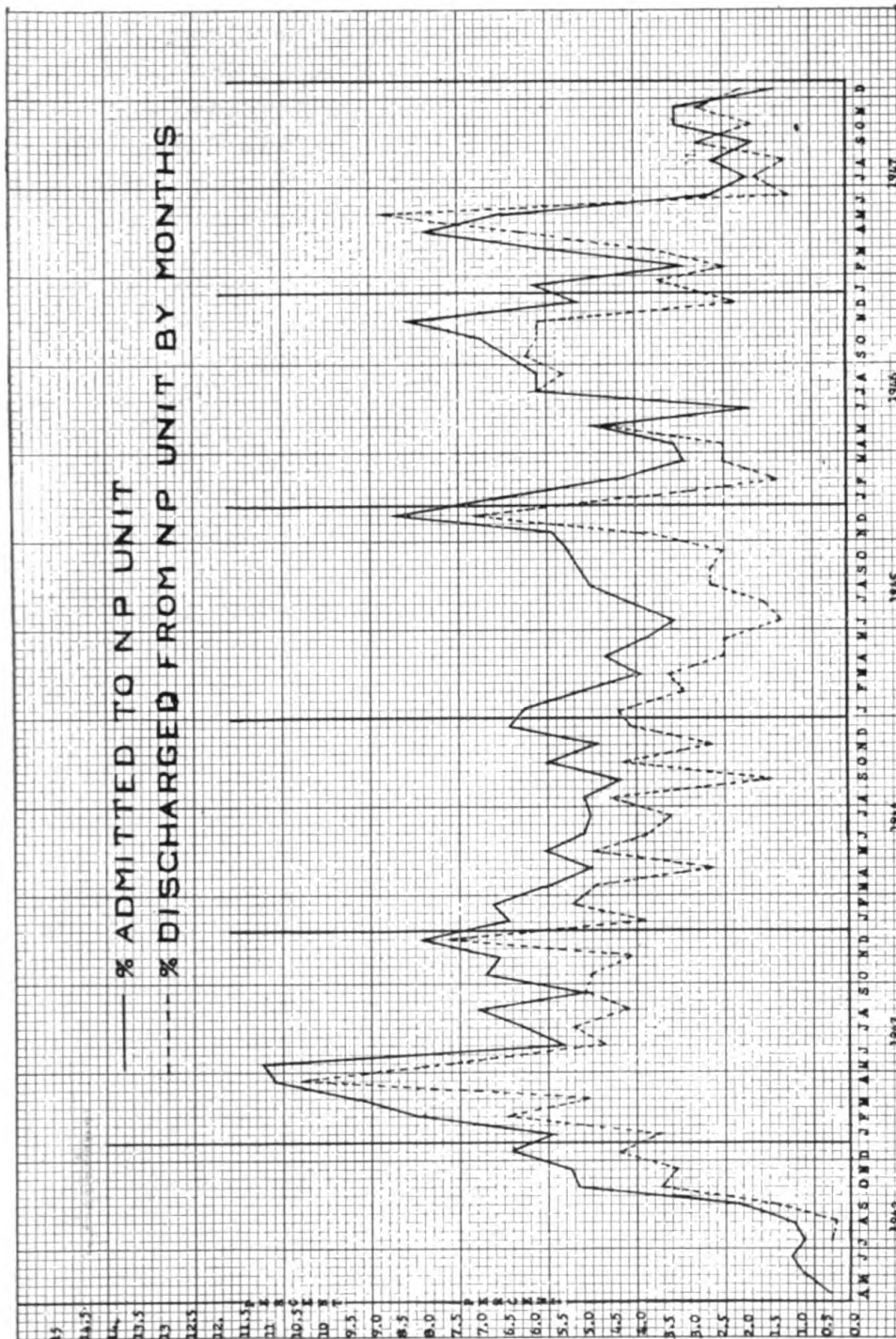


Figure 2.

It is figure 2, the percentage discharged, in which we are mainly interested. Some tell us that the percentage has been too high, others insist that it has been too low. The fundamental contribution of the neuropsychiatric clinic to the efficiency of the naval service is not to obtain a certain percentage discharged, be it high or low. The fundamental purpose of the neuropsychiatric clinic is to examine each individual, to accept him if he will be an asset to the service or to reject him if he would be a detriment to the service. The only error of the neuropsychiatric clinic is to accept a man who turns out to be a detriment, or to reject a man who would have been an asset.

The percentage discharged is merely a by-product of this fundamental objective. When the quality of incoming recruits is poor the percent rejected must of necessity be high; when the quality of incoming recruits is good the percentage discharged will automatically drop.

Figure 2 shows considerable variation. Moderate variation is expected in any measurement. More significant variations should be explainable by events and conditions which determine the quality of those being examined.

The remainder of this section will therefore be an attempt to trace the curve throughout the war and early postwar periods and to explain the causative factors for significant high and low percentages discharged.

Low regions of the curve should correspond with superior recruits, high regions with inferior recruits. The judgment and technique of the psychiatrist and psychologist should be a constant factor, but being subject to error, some discharge variation may have to be explained by variations in the behavior of the neuropsychiatric staff.

In tracing the relationships between causative events and their effects on the curve, one should bear in mind that the curve may not change abruptly the same month as the causative event. On the one hand, events may be anticipated by the public and the potential recruit may decide to enter the Navy on the basis of an expected condition. On the other hand, there is a lag. An event may affect the quality of recruits, but the discharge of those recruits may occur any time during the 3-month training period. With this double spreading effect, one may expect high and low regions on the curve near the time of the causative event.

THE EARLY MONTHS OF THE WAR

During the first half year of the war, the majority of people had not yet adjusted their life activities to the new situation. Most people continued working in the same locality. Some were drafted, but they went into the Army, for the Navy was then on a voluntary basis.

A war had begun, and we seemed to be on the losing side. The future looked dark, military life was dangerous. The safest thing to do was to wait until the draft card arrived.

Recruits who voluntarily enlisted at this time were, in general, superior specimens of high motivation and initiative. Less than 1 out of 200 of these recruits were discharged, *less than one-twentieth of the percentage of a year later*, about one-eighth of the average throughout the rest of the war.

A factor in addition to the quality of recruits during this period was that the neuropsychiatric clinic was still in process of organization, which may have decreased the percentage screened out.

THE SECOND HALF-YEAR

By the second half of the first year of the war, more people were adjusting to the new situation. It was becoming the usual, rather than the unusual thing, to volunteer for the service. Figure 1 shows how the incoming recruits increased from 12,000 to 42,000 per month during this period. They volunteered, but they had delayed in doing so. They were not quite so well motivated as their predecessors. Within 2 months the percentage discharged rose from $\frac{1}{2}$ to over 3 percent.

THE BEGINNING OF THE NAVY DRAFT

In February 1943, the Navy, for the first time, began to draft. Incoming recruits no longer were coming by choice, those with initiative and daring were fewer, many wished they were back home. *Within a 3-month period the percentage discharged rose from below 4 to over 10 percent, the highest point during the war.*

THE USE OF ADDITIONAL PSYCHIATRISTS AT RECRUITING AND INDUCTION STATIONS

When the percentage discharged reached its peak, following the beginning of the Navy draft, concern developed regarding the number of rejectees. Consequently, about May 1943 the Navy sent out additional psychiatrists to improve screening procedures at some recruiting and induction stations. As a result, the percentage discharged from the training centers dropped about June and never returned to the high peak of early 1943.

THE SEASONAL CYCLE

A glance at the curve from the middle of 1943 to the end of 1946 shows a tendency toward a seasonal variation. The percentage tends

to drop during the summers and rise during the winters. It appears that (a) there is a better selection of recruits during the summer, (b) neurotic tendencies become relaxed during the balmy days, or (c) psychiatrists and psychologists become less severe in their examining during the warmer days.

One may further note that in 1943, 1944, and 1945, the peak of the winter rise occurred in December. In December homesickness increases, the desire to be home for Christmas coupled with the inability to do so intensifies the strain of military training. During this period more recruits come to the clinic with nervous tension, headaches, and dizzy spells. These conditions occur partly on the voluntary level, bordering on malingering, but also at the subconscious level. The nervous tension really does become worse.

It is interesting to note that in 1946 the percentage drops during December. The present article was in preparation during that time and the psychiatrists and psychologists became aware of the "Christmas peak." The awareness of this effect probably caused an overcompensation in the minds of the examiners, so that a special effort was made to avoid sending any one home who might be malingering. As a result the "Christmas peak" became reversed for 1946. In 1947 all boots entering before Thanksgiving were allowed 2 weeks' Christmas leave. As a result a Christmas peak did not occur.

THE END OF THE WAR

With the end of the war in August 1945, the service was no longer a dangerous organization to be in. Therefore, it became an escape mechanism for many who could not adequately adjust at home, at school, or at work. Many recruits entered the service as an act of spite after an argument with the girl friend or with the family. As a result many incoming recruits were maladjusted individuals. They could not adjust to civilian life and they could not adjust to military training. Consequently the winter peak following the end of the war was the highest of the winter peaks.

THE SUSPENSION OF THE NAVY DRAFT

In January of 1946 the Navy Draft was suspended. The incoming recruits were those who wanted to be in the service and their motivation was therefore higher. The percentage discharged in early 1946 showed a quick drop from the winter peak.

THE DIMINISHING OF THE GI BILL OF RIGHTS

On 6 August 1946 the educational benefits of the GI bill of rights were decreased for further incoming recruits. As a result, those in-

terested in furthering their education were less likely to enlist. The average intellectual level of the recruits became lower, and the number of dull normal and borderline intelligence cases increased. These were less able to adjust to Navy training and more entered the clinic for this reason.

THE PRESENT TREND

The early 1947 trend of Navy recruits has been described by the authors in a separate article.² This trend revealed that an unusually large number of recruits at that time were of low intelligence and that a very large number of them were using the Navy as an escape from civilian maladjustments, a composite of points previously described under the headings "The End of the War" and "Diminishing of the GI Bill of Rights." These tendencies led to increasing percentages of discharges through May 1947, but with the closing of school, the quality and intelligence of the average recruit was greatly raised by the influx of high school graduates, bringing the percentage of discharges for June 1947 down to 1.93 percent. Although rather large numbers of low intelligence are again finding their way into the Navy, considerable numbers of recruits who have completed high school are still coming in. The elimination of mustering-out pay for those enlisting after 30 June 1947 appears to have had no appreciable effect on the quality of enlistees. In addition, the neuropsychiatric clinic has made a conscious effort to discharge only those recruits who in the opinion of all members of the aptitude board are entirely beyond salvaging, due to the increasing need for replacements because of the large number of expiring enlistments during this latter period. The paradoxical crossing over of the curves in May 1947 is due to the accumulation of a backlog of discharges from April who were not discharged until the following month. This is repeated in September 1947.

TYPES OF DISORDERS DETERMINING UNSUITABILITY

An analysis of discharges for 1946 gives a general idea of the types of conditions which render the recruit unfit for Naval service. Table 1 gives the nearest percentage of each condition encountered. Many patients exhibit a combination of two or more of the disorders; the classification is based on the most pronounced condition of each case.

² REITZEL, E. C.; MILLER, V. L.; and KNOX, G. W.: *Psychiatric Screening in the Post-war Navy*. Published in mimeograph form by the Medical Department, U. S. Naval Training Center, Great Lakes, Ill., April 1947. 15 pp.

TABLE 1.—*An analysis of the neuropsychiatric diagnoses for the rejection of recruits*

Diagnosis and reason for discharge:	Percentage
Personality disorder.....	64
Enuresis.....	11
Mental defective.....	5
Intracranial injury and neurological.....	4
Somnambulism.....	3
Migraine.....	3
Epilepsy:	
Grand mal.....	1
Petit mal.....	1
Convulsive disorder (psychomotor and mixed).....	1
Psychopathic instability.....	1
Psychoneurosis (anxiety reaction).....	1
Psychoneurosis (unclassified).....	1
Schizoid personality.....	1
Speech defect.....	1
Pathologic sexuality.....	1
Psychoses.....	1

It is quite evident that personality disorder (inability to make an adequate social adjustment) is the outstanding reason for discharge. This is the expected result, since the Navy is a social organization where cooperation and harmony between individuals is the most fundamental necessity. Many cases of personality disorder are accompanied by a mild nervous condition, dull normal intelligence, or both.

Although a mental defective diagnosis was given to only 5 percent of the cases, this condition in milder form contributed to the decision of Unsuitability for many cases otherwise classified, especially of the personality disorders. The classification of mental defective is given only to those of moron level or below (less than 70 I. Q.). Many personality disorder cases were either of borderline intelligence (70 to 80 I. Q.) or of dull normal intelligence (80 to 90 I. Q.). Twenty percent of all discharges were below normal intelligence, 15 percent falling within the I. Q. range of 70 to 90 and 5 percent being below 70.

Seventeen percent of all discharges exhibited symptoms suggestive of organic involvements and were therefore given electroencephalographic examinations. Results indicated that only 7 percent actually had organic involvements, the other 93 percent being functional in nature, but 10 percent of all cases had functional disorders which simulated symptoms of organic conditions.

SUMMARY

There has been considerable debate concerning the percentage of recruits which should be discharged from the naval neuropsychiatric clinics of the training centers.

Consequently, a survey was made of the neuropsychiatric discharges out of over a million recruits examined in approximately a 5-year period at the world's largest naval training station, throughout the war and early postwar periods.

The discharge of a certain number of recruits, be it high or low, is not the fundamental objective of the neuropsychiatric clinic. The fundamental objective is to discharge only those who would be more of a detriment than an asset and to retain those who will be more of an asset than a detriment.

With this objective, a fluctuation in the percentage discharged is expected with a variation in the quality of incoming recruits. This variation in the quality of recruits was determined by many changing conditions throughout the war and postwar periods.

Some of the factors which determined the fluctuation in the quality of recruits, and, consequently, in the percentage discharged, are pointed out.

ACKNOWLEDGMENT.—The authors are indebted to Capt. Earl Richison (MC) USN, for valuable advice in the preparation of this article; to the numerous officers attached to the Neuropsychiatric Unit of U. S. Naval Training Center, Great Lakes, Ill., since April 1942, for accumulation of the data; and to Bertha P. Kuznik, PhM2c, V-10 USNR, and Neal R. Roy PhM3c, USN, for assistance in preparation of the manuscript and charts.



A RAPID TECHNIQUE FOR THE DIAGNOSIS OF SCABIES

CEDRIC C. CARPENTER
Commander (MC) U. S. N. R.¹

IT IS always a source of satisfaction to verify a clinical diagnosis of scabietic infestation by actual microscopic demonstration of the mite or its products. In many cases, however, such evidence is not always obtainable, particularly in those patients who recently have received antiscabietic therapy, or in those who are being used as intermediary hosts by the scabietic parasites which normally inhabit dogs, cats, and canaries (1).

Among the several methods of demonstrating the causative organism, which have been described by various authors, probably the oldest is teasing the female parasite out of a burrow with a needle (2) (3) (4) (5) (6). However, this procedure is time-consuming and rarely demonstrates the ova and scybala, which, also, are positive evidence of infestation, even though the mite itself is missed.

Shavings from the tops of burrows or papules, removed by a sharp scalpel or razor blade (3) (7) (8) and clarified for microscopic examination by the use of a solution of potassium hydroxide, have the advantage of demonstrating the mite as well as its products, as beautifully illustrated in the microphotographs by Hand (8) in a recent issue of the BULLETIN. This method, however, has its exasperating moments, particularly if the skin still is slippery from its preparation with alcohol, but this problem may be obviated by firmly holding the papule with a "mosquito clamp" while the top is shaved off.

A more recent method is described by Friedman (9) in which he uses a curved, sharp Bard-Parker blade to scrape the suspected lesion and to transfer these scrapings to a microscopic slide for examination.

In an effort to find a more rapid technique than those described previously, and one that would demonstrate the mite and its products as completely as the aforementioned shaving technique, the author has made use of a Skeel's serrated eye curet.

The best preparations are made from fresh papulovesicles or burrows which do not show any hemorrhagic crusting from previous

¹ Inactive.



Figure 1.—*Removal of an entire scabietic papule with a Skeel's serrated eye curet.*

excoriation. Following proper sterilization of the instrument and the overlying skin with alcohol, the sharp teeth of the curet can be inserted into the base of the lesion and, with a quick, turning motion of the wrist, the whole papule or part of a burrow may be removed. (See fig. 1.) Using this method, several papules or burrows may be removed rapidly from various diagnostic areas, such as between the fingers, on the wrists, in the axillary folds, near the navel and on the buttocks. These skin curettings are transferred to a microscopic slide, one to two drops of 15 to 20 percent potassium hydroxide are added and a coverslip is applied. Following gentle heating of the slide over an alcohol burner, without boiling the hydroxide solution, the keratin in the skin becomes clarified, without any disintegration of the acarus or its products. Gentle pressure should be applied to the top of the coverslip with a pencil until the curettings are flattened out to a thickness of one cell, thus facilitating microscopic examination with the low power lens. By this method the mite, larva, ova and scybala or

disintegrated chitinous plate of the parasite may be identified readily. As the mite is quite deep in the epidermis, proper curetting should include some of the elastic and fibrous tissue fibers of the upper cutis. These should not be confused with fungus mycelia when seen microscopically.

REFERENCES

1. MARTIN, H. M.: Parasitic skin diseases of domesticated animals and their importance to dermatologists; review. *J. Invest. Dermat.* 1: 313-324, Oct. 1938.
2. LANE, J. E.: Bonomo's letter to Redi; important document in history of scabies. *Arch. Dermat. & Syph.* 18: 1-25, Sept. 1928. Cited by HAND, E. A. (8).
3. ANDREWS, G. C.: Diseases of the Skin. W. B. Saunders Co., Philadelphia, Pa., 1932. p. 793.
4. LUNN, H. F.: Recognition of scabies by army medical officer. *J. Roy. Army M. Corps* 79: 203-206, Oct. 1942.
5. MACCORMAC, H.: Diagnosis and treatment of scabies. *J. Roy. San. Inst.* 63: 24-25, Jan. 1943.
6. BACON, L. J.: Diagnosis of scabies. *M. Officer* 71: 101-103, Mar. 25, 1944.
7. ORMSBY, O. S.: Practical Treatise on Diseases of the Skin for the Use of Students and Practitioners. 5th edition. Lea & Febiger, Philadelphia, Pa., 1937. p. 1108.
8. HAND, E. A.: Diagnosis of infestation with "*Sarcoptes scabiei* var. *hominis*"; discussion of life cycle of organism. *U. S. Nav. M. Bull.* 46: 834-844, June 1946.
9. FRIEDMAN, R.: Atypical scabies; diagnosis by scrape and smear method. *Pennsylvania M. J.* 47: 39-41, Oct. 1943.



CLINICAL PATHOLOGICAL CONFERENCE

WILLIAM M. SILLIPHANT
Captain (MC) U. S. N.

PRESENTATION OF CASE

A 43-year-old white male was admitted to a United States Naval Hospital with the complaint of nervous indigestion. He had enjoyed excellent health until 3 weeks prior to admission, when he developed indigestion and uncomfortable sensations in the epigastrium. There was no history of diarrhea, tarry stools or gastric pain. He vomited some slightly blood-streaked material on one occasion shortly before admission. He tired easily and became moderately short of breath on relatively slight exertion. During the 3 weeks prior to admission he lost 15 pounds in weight. The patient was apprehensive and believed that he had malaria or cancer.

Physical examination revealed very little in the way of positive findings. The temperature was 99.2° F., the pulse rate was 135, respirations were 18, and the blood pressure was 135/90. There was a gross tremor of the hands. There was no exophthalmus and the thyroid gland was not palpable. Except for an occasional bronchial wheeze the chest was clear. No areas of tenderness nor masses were found in the abdomen.

Laboratory examinations were as follows: The ECG was unremarkable. The urine was negative. A BMR was unsatisfactory because of the patient's failure to breath smoothly. A chest film was negative. Examination of the blood revealed hemoglobin of 13.5 grams and a red count of 2,400,000 and a white count of 17,200 with 1 band form, 74 segmented cells, 15 lymphocytes, 6 monocytes, and 4 eosinophils. Ten normoblasts were noted per 100 white cells. The red cells showed anisocytosis, poikilocytosis and polychromasia, basophile stippling and rare Cabot rings. The platelet count was 75,000 and the sedimentation rate 2 mm. in 1 hour. Bleeding and coagulation times were normal. Clot retraction was normal. The prothrombin time was 76 percent of normal.

On the fifth hospital day numerous bruises were noted on the extremities and patient was questioned about them. He stated he had often bruised easily and he ascribed them to restlessness and moving about in his sleep.

On the seventh hospital day the patient vomited a small amount of blood and appeared pale, restless, anxious, and acutely ill.

On the ninth hospital day the patient continued to vomit small amounts of blood and began passing tarry stools. The liver and spleen were not palpable. There was no lymphadenopathy and no jaundice. At the onset of the gastro-intestinal hemorrhage the patient was transfused and received vitamins K, C and calcium. X-rays of skull, lumbar vertebra, pelvis and long bones were negative. There were numerous ecchymotic areas in the skin.

He presented numerous petechiae. The capillary fragility test (Rumpel-Leeds) was markedly positive. One small retinal hemorrhage was noted. The red cell fragility test was normal. On one occasion the clot retracted poorly; on two other

occasions there was normal clot retraction. The icterus index, the van den Bergh test, cephalin flocculation test, and blood cholesterol studies were not remarkable.

Numerous blood studies were done, the results of which are shown in table 1. Two bone marrow studies were done; one showed diminution in megakaryocytes; the other was aplastic. The blood sedimentation rate increased to 22 mm. in 1 hour.

Patient continued to show marked normocytic anemia, leukocytosis with a shift to the left, thrombocytopenia, and from 10 to 86 nucleated red cells per 100 white cells, and evidences of red cell immaturity.

On the thirtieth hospital day a gastro-intestinal series revealed an extensive irregular filling defect involving a greater portion of the stomach.

On the thirty-ninth hospital day he had difficulty in talking and slight jaundice was noted. He developed respiratory distress and the lungs became filled with râles. He died on the thirty-ninth hospital day, 2 months after onset of his first symptoms.

TABLE 1.—*Blood studies*

	Hospital day								
	2	6	8	10	11	12	22	27	34
Hemoglobin	13.5		7.7	6.25	5.2	5.7	7.7	5.7	6
Red blood cells			1.9	2.0	1.8	1.8	2.4	1.6	2.3
White blood cells	17,200		19,400	15,800	19,000	15,600	6,200	15,600	10,650
Mononuclears				2	1	1		3	2
Juveniles			7	4	6	4	4	3	6
Basophils	1		2	9	18	10	4	7	10
Segmented cells	74		63	59	50	55	64	60	54
Lymphocytes	16		17	14	16	24	15	18	21
Monocytes	6		6	6	6	3	10	6	5
Eosinophils	4		5	3	3	2	3	2	1
Banded forms				3		1		1	1
Platelets	75,000		20,000	10,000	19,000	23,000			13,800
Bleeding time (minutes)		3½		5½	2½				
Clotting time (minutes)		2		3	3½				
Clot retraction				(1)	(2)	(1)			
Prothrombin (percent)			76	59				103	
Nucleated red blood cells per 100 white blood cells				10	15	33	67	86	37
Sedimentation rate (mm.)	2							23	
Bone marrow				(3)					(4)

¹ Normal.

² Very poor.

³ Megakaryocytes diminished.

⁴ Aplastic.

DIFFERENTIAL DIAGNOSIS

On admission hyperthyroidism was considered because of the tremor of the hands and rapid pulse rate. This was ruled out on the basis of no thyroid enlargement, lack of hypertension, and a normal ECG.

Also considered was peptic ulcer. In favor of this diagnosis was the rather vague abdominal complaints, the blood streaked vomitus and tarry stools. The patient was first treated for this condition.

As more information was received on the blood studies some type of blood dyscrasia was considered, in particular purpura hemorrhagica. The patient showed a marked diminution in platelets, a positive Rumpel-Leeds test, normal coagulation time, and on one oc-

casion poor clot retraction, petechiae and gastro-intestinal hemorrhages; all findings associated with purpura hemorrhagica. However, purpura hemorrhagica usually occurs in children and young adults and this patient was 43 years of age. Also the bleeding time was normal, and it is prolonged in purpura hemorrhagica. As a rule in purpura hemorrhagica the leukocytic changes are not significant but there may be a leukocytosis in the presence of hemorrhage which this patient had. The anemia was rather severe—probably too severe for purpura hemorrhagica in which there is no more anemia that can be explained on the basis of hemorrhage alone. Moreover in purpura hemorrhagica this tremendous increase in normoblasts in the peripheral blood does not usually occur.

In this patient it is necessary to find a disease which will produce a thrombocytopenic purpura, a severe anemia, and normoblastosis.

The disease process in this patient appears to fall in that group of diseases in which there is a space occupying lesion in the bone marrow with replacement of the marrow elements and the development of foci of extramedullary hemopoiesis. The gastro-intestinal series showed a defect in the stomach. The diagnosis then appears quite clear: carcinoma of the stomach with metastases to bone marrow, and myelophthisic anemia. In some patients with carcinoma the presenting symptom is purpura and the diagnosis may not be considered until quite late.

The negative findings on x-ray of the skeleton do not rule out extensive involvement of the skeleton by metastatic lesions. In fact, in infiltrating carcinomas of this type it is the rule not to have destructive lesions of bone. The cancer cells produce a fibrosis of the marrow with replacement of the bone marrow cells and the development of extramedullary hemopoiesis. In those cases in which there are destructive lesions in the bone there is usually little or no fibrosis of the marrow and as a rule the picture of myelophthisic anemia is not seen. The fibrosis of the bone marrow also explains the diagnosis of aplasia of the bone marrow noted in this case on sternal aspiration. With fibrosis few or no cells are aspirated which leads to that diagnosis. Also, it is difficult in these cases to find malignant cells in the sternal aspirate since they are so intimately bound to stroma that they are freed with difficulty. The thrombocytopenia is also explained on a replacement fibrosis of the marrow stimulated by the carcinoma cells which interfere with normal platelet production. Again, in foci of hemopoiesis, megakaryocytes may be rare or lacking while erythropoiesis and myelopoiesis may be proceeding quite well. The striking finding then in the peripheral blood is a thrombocytopenia in the presence of normoblastosis and leukocytosis. This normoblastosis is believed due to improper mobilization of cells into the pe-

ipheral blood. While in the bone marrow the regulatory mechanism of not permitting immature cells to gain entrance into the peripheral blood is present, it is lacking or defective in the extramedullary hemopoiesis of liver, spleen, lymph nodes, and elsewhere.

In myelophthisis anemias there is an increase in normoblasts but of proportion to that seen in the same degree of anemia which occurs from other causes such as blood loss. In this case there was severe anemia but of insufficient degree to explain the presence of 86 nucleated red cells per 100 white cells in the peripheral blood. The severe gastric hemorrhage undoubtedly aggravated the existing myelophthisic anemia. In myelophthisic anemia there may be a marked shift to the left with the presence of immature forms of the myeloid series in the peripheral blood; in some cases to such a degree to suggest the diagnosis of leukemia. The platelet count may be normal or thrombocytopenia may be found in the presence of a normal number of leukocytes.

CLINICAL DIAGNOSIS.—Carcinoma of stomach with myelophthisic anemia and thrombocytopenia.

PATHOLOGICAL DISCUSSION

Autopsy revealed the body of a well-developed 43-year-old white male weighing 173 pounds and measuring 72 inches. There was a slight yellow tint to the skin and sclerae. Numerous small petechiae were present in the skin of the forehead, trunk and feet. There was a large ecchymosis in the skin of the middle third of the sternum at the site of sternal aspiration.

There was a carcinomatous ulcer, 4 cm. in greatest diameter, located in the greater curvature of the stomach in the central portion. The entire stomach wall was thickened and infiltrated by tumor. Although the lumen was narrowed, there was no obstruction. The gross picture was one of linitis plastica. The base of the ulcer was filled with blood. The colon was filled with old blood. The liver was enlarged and weighed 2,360 grams, and showed five 3 cm. nodules of metastatic tumor tissue. The spleen was also increased in size, weighed 360 grams, and was soft. The malpighian bodies were indistinct. Almost all of the visceral lymph nodes were involved with tumor tissue. This replacement by tumor tissue was more marked in the hilar nodes of the lung and liver, and the regional nodes of the stomach. The marrow of the ribs, the body of the sternum, the lumbar and thoracic vertebrae, showed replacement by a firm yellow-white fibrous tissue. There was no destruction of bone; the trabeculae of the cancellous bone appeared thickened. On pressure of the ribs, no marrow could be expressed, but only a thin pink fluid. Examination of the mid-shaft of the right

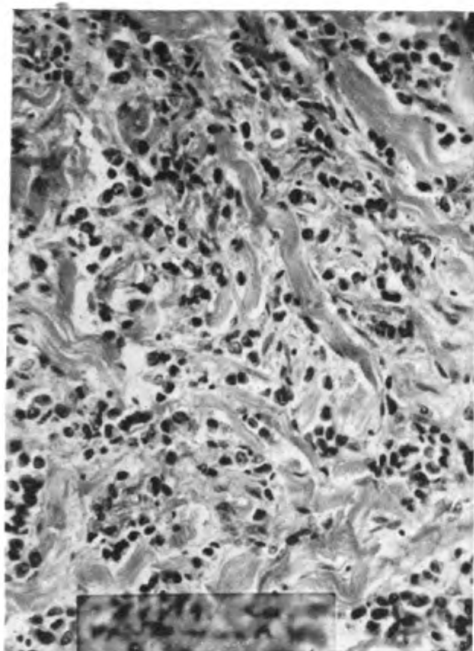


Figure 1.—*Infiltration of musculature of stomach with cancer cells.*

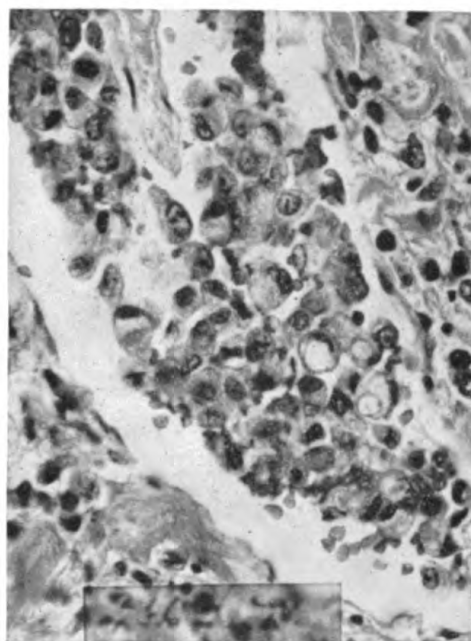


Figure 2.—*Cancer cells in capillary. Note the signet ring cells.*

femur showed abundant semi-fluid, red-gray bone marrow. The lungs together weighed 1,660 grams, and showed congestion and edema on gross examination.

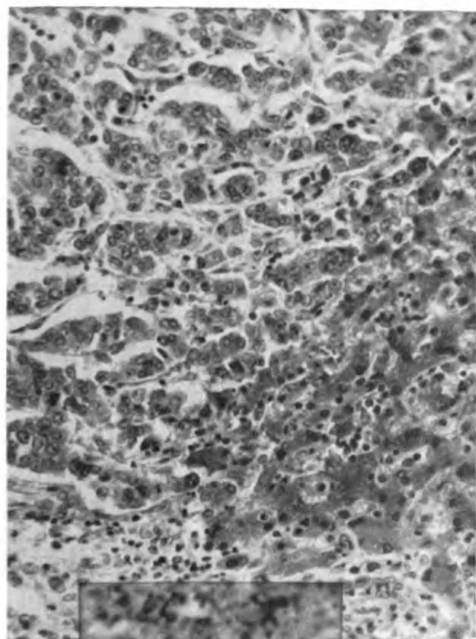


Figure 3.—*Carcinoma metastatic to liver.*

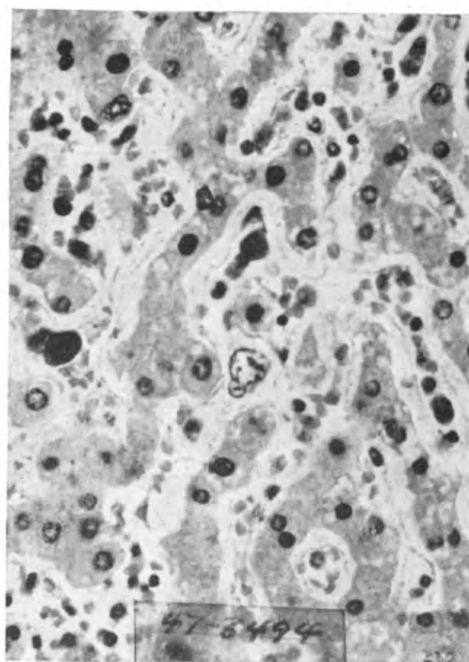


Figure 4.—*Extramedullary hemopoiesis in liver. Note the megakaryocyte.*

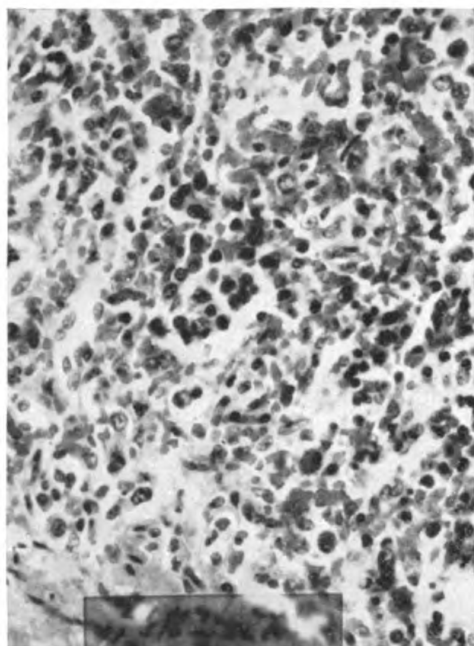


Figure 5.—*Extramedullary hemopoiesis in spleen.*

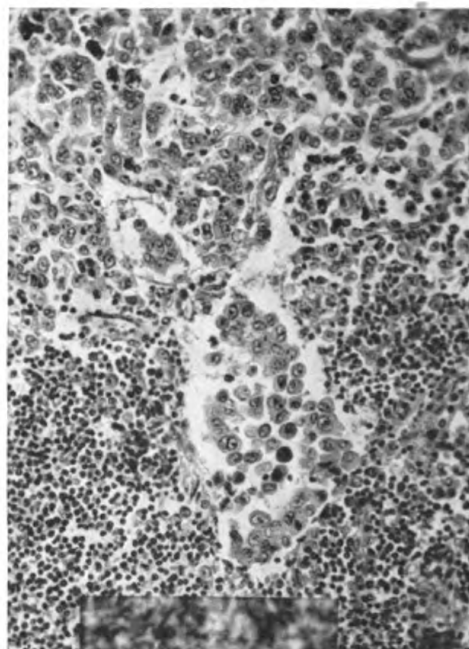


Figure 6.—*Cancer cells in sinusoids of lymph node.*

The neck organs, pancreas, heart, adrenals, kidneys, bladder, prostate, and testes were unremarkable.

On microscopic examination the wall of the stomach was thickened and showed a diffuse infiltration of all layers by malignant epithelial cells. The glands and musculature of the stomach were separated by the cords of tumor cells, but there was only destruction of tissue in the region of the carcinomatous ulcer. The cells for the most part were small with an eccentric hyperchromic nucleus, and abundant cytoplasm. These cells represented the so-called signet ring type of tumor cell. In other areas the tumor was more differentiated and formed closely packed masses in alveolar arrangement. There was much fibrous tissue reaction in response to the tumor cells. Figure 1 shows diffuse infiltration of the musculature of the stomach with tumor cells and the resultant fibrous reaction. Figure 2 is through the musculature of the stomach and shows a mass of tumor cells in a capillary. The signet ring shape of the cell is well illustrated. Both capillaries and lymphatic contained masses of tumor cells.

Sections of liver showed tumor cells compressing and infiltrating the parenchyma (fig. 3). Also present were numerous foci of hemopoiesis in the sinusoids (fig. 4). In one of these foci is a megakaryocyte.

The spleen also showed numerous areas of hemopoiesis in the sinusoids (fig. 5).

Figure 6 shows masses of malignant cells in the sinusoids of a gastric lymph node.

In the lungs there were masses of malignant cells in both capillaries and lymphatics.

Sections of rib showed the marrow to be almost completely replaced by a fibromyxomatous tissue in which numerous malignant cells were embedded. Some of the masses were necrotic. In general, the trabeculae were well preserved, there being only little erosion. The bone marrow of the middle third of the femur was hyperplastic with active areas of hemopoiesis; a few nests of cancer cells were also present.

PATHOLOGICAL DIAGNOSES.—(a) Infiltrative carcinoma of stomach with massive gastric hemorrhage; (b) metastases to lymph nodes, lungs, liver, and bone; (c) myelofibrosis of bone; myelophthisic anemia; (d) extramedullary hemopoiesis of liver and spleen; (e) jaundice, slight; and (f) petechiae and ecchymoses of skin.

The pathogenesis in this case appears to be as follows: The development of carcinoma of the stomach with metastases to bone marrow; fibrosis of bone marrow of almost all flat bones due to tumor cells; replacement of bone marrow cells by fibrosis; anemia, thrombocytopenia with development of purpura; reversion to fetal type of hemopoiesis in liver and spleen; release of immature cells into peripheral blood with leukocytosis, shift to the left, and normoblastosis; gastric hemorrhage from carcinomatous ulcer.

The clinical picture and pathologic findings in this case may be explained on two characteristics of the tumor cell. (1) Its ability to produce fibrosis and (2) its ability to invade without causing destruction of tissue.

The clinical symptoms were at first quite vague at the time of onset of symptoms the stomach was probably extensively infiltrated with tumor. These tumor cells infiltrate widely, do not establish fungating masses, nor produce obstruction. Quite often the carcinomatous ulcer will be quite small, and by x-ray little more than disturbance in mobility and decrease in size of the lumen of the stomach are observed. The patient was not cachectic due to the rapid course of the disease, the lack of infection of the carcinoma and the absence of obstruction in the intestinal tract.

It is not the usual picture for patients with carcinoma of the stomach to have massive gastric hemorrhage. In this case, however, due to the replacement of the marrow by fibrous tissue there was a severe thrombocytopenia, with a general bleeding tendency as manifested by the petechiae in the skin and retinal hemorrhages and the massive hemorrhage from the carcinomatous ulcer. The enlarged spleen and liver are due to the extra medullary hemopoiesis.

Ordinarily, in adult life, the long bones consist almost entirely of fatty marrow. In this case as a result of the replacement of the bone marrow of the flat bones the long bones shows compensatory hyperplasia of marrow elements.

The unusual feature in this case is the presenting clinical picture of purpura in carcinoma of the stomach associated with thrombocytopenia, leukocytosis and normoblastosis. The blood picture was quite unusual and difficult to interpret. As a rule in myelophthisic anemia, there is normoblastosis with mild anemia. In this case the anemia was aggravated by the repeated gastric hemorrhages due to thrombocytopenia to give a rather atypical picture of myelophthisis anemia.

The important feature in this case is that an increase in normoblasts in the peripheral blood associated with anemia should suggest metastases to bone marrow.



NAVAL MEDICAL HISTORY



A WARTIME LOG OF THE UNITED STATES NAVAL HOSPITAL SHIP *SOLACE* FROM JUNE 1943¹

PART I

EUGENE H. DRAKE

Captain (MC) U. S. N. R.

WILLIAM W. STRANGE

Captain (MC) U. S. N. R.

HOWARD B. SPRAGUE

Captain (MC) U. S. N. R.

and

ARTHUR P. MCGINTY

Commander (MC) U. S. N. R.

During the summer of 1943 the U. S. S. *Solace* lay at anchor in Noumea Harbor, New Caledonia, serving as station ship and receiving patients from the Fleet. An alert was ordered and the area placed in Condition One for 1½ hours as midnight approached on 11 August.

On 21 August Capt. John T. Bennett (MC) USN reported to relieve Capt. Melville J. Aston as senior medical officer. Capt. Aston was detached 25 August. Three days later all but 20 patients were transferred to the U. S. S. *Relief* and the following day the *Solace* sailed. She arrived at Havana Harbor, Efate, 31 August and remained in port for a month. Medical staff conferences held on 20 and 27 September were attended by medical officers from the Fleet and from shore-based activities.

Thirty-five patients for evacuation were received from the U. S. Naval Base Hospital and 166 patients from the 48th Army Station Hospital on 1 October. The next day 63 naval personnel and 194 Army patients were loaded at Espiritu Santo. These patients were transferred at Auckland, New Zealand, 7 October, the Navy patients going to Mobile Hospital No. 4. The next day the ship sailed for Wellington, arrived 10 October and was put in dry dock.

¹ This is a continuation of the wartime log of the United States Naval Hospital Ship *Solace* and really forms a sequel to the account by Commodore Richard A. Kern (MC) USNR and Capt. Melville J. Aston (MC) USN which was published in the November 1946, December 1946, January–February 1947, and March–April 1947 issues of the U. S. NAVAL MEDICAL BULLETIN. Part II will appear in the September–October number.

The *Solace* sailed for Suva, Fiji Islands, 22 October and arrived 26 October. Two hundred and ninety-four patients were received from the U. S. Naval Dispensary, Navy 130, and from the 142d and 188th Army General Hospitals. Two hundred and thirty-five patients from Mobile Hospital No. 3 were embarked at Pago Pago, American Samoa, on 28 October. Departure was taken 29 October for an evacuation run to the States. On 4 November a stop was made at Honolulu to take on three Army Nurse patients. The ship was docked at San Francisco 9 November; the Navy patients were sent to Mare Island Naval Hospital and the Army patients to the Letterman General Hospital. She sailed from San Francisco on 12 November.

The third week of November 1943, found the ship sailing in equatorial waters toward the Ellice Islands, advance base and staging area for the coming campaign in the Gilbert Islands. According to plan, the *Solace*, after fueling at Funafuti Atoll, was to follow the fleet to the Gilberts. Here she was to take on casualties at Apamama Atoll returning to transfer patients to the U.S.S. *Relief*, whose duty it was to remain as station ship at Funafuti. But a change of plan was made necessary by the severity of the action at Tarawa and the resulting increase of wounded beyond the number expected.

A message was received on 22 November diverting the *Solace* to the Gilbert Islands. Course was changed to Apamama where she arrived on Thanksgiving morning. After a brief delay, 235 casualties were loaded from attack transport *Zeilan*, *Harry Lee*, *Harris*, *Feland* and *Arthur Middleton*. Although the Amphibious Command had given orders that the transports should transfer their patients to the hospital ships, only this small number was received. Several ships sent word that their patients were too ill to be moved. The transfer was accomplished by means of our own launches, to each of which a medical officer was assigned. One wounded prisoner of war was admitted from the U.S.S. *Meade*.

Never before had either hospital ship been ordered to the forward area. The wounded received at Apamama had been aboard the transports from 1 to 3 days; a relatively high percentage of our patients had penetrating wounds of the chest, inflicted by machine-gun and rifle fire as the troops were wading ashore from landing craft stranded on outlying reefs.

Although the bed capacity of SOQ had been increased from 15 to 35, the number of beds for officers was insufficient and it was necessary to care for a dozen officers in the adjacent emergency ward. Later on we came to learn that a high proportion of officer casualties is the common result of Marine Corps warfare.

The operating rooms were busy with little respite for the first 48 hours.

As the last load of patients was being carried aboard the ship, the *Relief* appeared off the atoll. She stopped to take patients from a submarine, then proceeded to the anchorage.

There were other problems on the *Solace* beside those which engrossed the medical department. The ship had just finished the long trip west from San Francisco and the diversion directly into the Gilberts had deprived her of the expected opportunity to refuel at Funafuti. It was necessary to take on fuel at once. As soon as loading was completed and sailing orders obtained, the anchor was weighed and the *Solace* set out for a rendezvous with a tanker. But no tanker was to be found at the appointed spot. It was months later when we finally heard the whole story, how the task force commander had been obliged to move from the area hurriedly, taking our fuel supply with him. The night and the following day were spent in attempts to secure oil. Late in the afternoon when our fuel supply was sufficient for only a few more hours, three Navy tankers appeared on the horizon.

Some say that there are vessels in the Navy whose lines are sweeter than those of a tanker, but 22 November would have been an inopportune day to voice such a thought on board the *Solace*. The U. S. S. *Pecos* drew ahead of her sisters, reached us on a parallel course, and with a matter of fact air began the process of transferring oil. This was a new and highly interesting maneuver to many of us, although Captain Gunnell of the *Pecos*, overseeing the procedure from his flying bridge, seemed mildly bored with it all, as if this were not the first time he had ever fueled a loaded hospital ship underway in the combat zone. First off, a hand line was shot across our bow by means of a short-barreled shotgun; then hawsers were pulled aboard which, along with spring lines, kept the two ships together; finally the oil hose was taken and secured in place.

So we set our course for Pearl Harbor while the beautiful black oil rose in our tanks. In a surprisingly short time we had fuel enough. With thanks we cast off the good *Pecos*, watched the oilers veer away and grow smaller until they disappeared.

That night we ran into a smart head wind and choppy sea. For 2 days it was an effort to keep one's balance in the forward operating rooms, and a few of the ship's company were troubled in body and spirit. But there was at hand plenty of the sovereign remedy for sea sickness—work to do; all hands were busy and soon even our new nurses on their first cruise were walking the decks with the slightly rolling gait of the old sailor.

We sailed into Pearl Harbor the morning of 2 December in a drizzling rain and were edged alongside the Ten Ten Dock. But the rain had not kept away the Marine Band or Admiral Nimitz and his staff and

all the generals and colonels of the Marine Corps, as well as several hundred others. They were on hand to welcome and honor some of the survivors of what the Marine Corps said was the toughest engagement they had ever encountered.

Our patients were transferred to the new hospital at Aiea. There followed 2 weeks in port with liberty for the men.

On 15 December the ship pulled into the dock and loaded 465 Marine Corps patients for transportation to the mainland from the Aiea and Pearl Harbor hospitals. Early the next morning Admiral Nimitz with his staff, Marine Corps Generals Holland Smith and Julian Smith and others visited the ship to present Purple Heart Medals to the patients. At the conclusion of these ceremonies the *Solace* sailed for San Diego. After an uneventful voyage we arrived 23 December. The ship was docked at once and the patients transferred to the San Diego Naval Hospital.

Christmas at home. What a fine present! And the second consecutive month the ship had come back to the States. If you could count on keeping to that schedule, this would be extra fine duty.

Many officers and men enjoyed leave during the next 2 weeks. Others were visited in San Diego by their families. There were dinner parties in the wardroom and ashore.

As the old year ran out and the totals were added, it was found that the *Solace* had traveled 27,069 miles in 1943. During the year, 51½ months were spent in Noumea, New Caledonia, and 1 month in Havana Harbor, Efate, acting as station ship. Seven trips were made for evacuation of patients to New Zealand and two voyages to the mainland of the United States. Near the end of the year the ship was ordered to take part for the first time in a Marine amphibious assault, admitting patients from Tarawa, Gilbert Islands.

With the ship cleaned and in good repair, everyone made the most of the slender treasure of days left to spend in the homeland, expecting each night to be the last for months to come.

The *Solace* sailed for Pearl Harbor on the morning of 15 January and arrived 1 week later.

The ship departed from Pearl Harbor for the Marshall Islands. Roi and Namur Islands, at the northern end of the huge Kwajalein Atoll, were sighted soon after sunrise 3 February. As we rounded the tip of the atoll, several brisk fires were burning and the skeletons of two large hangars could be recognized in the foreground. Machine-gun fire continued ashore but we were informed that organized resistance had just ceased. The ship was piloted to the transport anchorage off Roi Island. During the day 264 patients were taken aboard from transports. This was accomplished in part by LCVP's and LCM's, in part by our own ship's launches. The plan of sending

a medical officer with each small boat was given up. The boat trips were short and all of our medical officers were needed aboard to care for the avalanche of patients.

The night was spent at anchor and under full black-out conditions. Work continued in the medical spaces through the night. By morning everyone showed the effects of fatigue, loss of sleep, high temperature and humidity. The first fresh air that blew through the wards when, at daybreak, the black-out could be discontinued was a tonic to the patients as well as to those who cared for them.

During the forenoon our sailing orders arrived and we started the back trip to the base. The week's journey was not too long a time to institute definitive treatment for all the patients. Four seriously wounded men died during the voyage; since 333 of the total patient census were battle casualties, the mortality among the wounded alone was 1.2 percent. On the basis of the total patients admitted it figures a flat 1 percent.

We arrived at Pearl Harbor the morning of 11 February. Ambulances were waiting as we drew up to the dock and the patients were evacuated at once to the Aiea Heights Hospital. The next morning we were underway again for the Marshall Islands.

A medical staff conference was held on the outbound voyage. The chief of surgery led an interesting discussion on the treatment of burns, placing particular emphasis on the maintenance of fluids, electrolytes and plasma. The local use of tannic acid had already been given up and we were getting away from the local application of sulfonamides. The administration of sulfonamides and penicillin to wounded men was also debated. Our supply of penicillin was quite limited so that its use was of necessity restricted to serious cases. The chief of surgery designated by the senior medical officer was to determine whether penicillin should be administered in a given case and to be responsible for the detailed reports submitted to the Bureau of Medicine and Surgery, Navy Department, in each instance.

We reached the Kwajalein Atoll 18 February and were given an anchorage abreast of Allen Island. Several officers were able to go ashore and view the medical facilities in operation and those being built. The air field was functioning and night fighters were already on the base. Wreckage had been largely cleared away. Here we had our first opportunity of observing the architecture of the massive enemy pill boxes and block houses, built of concrete reinforced by iron. A concrete power house on Roi Island was being repaired by doctors and corpsmen, preparatory to its use as a temporary hospital. Allen Island was the site of one of Japan's largest radio stations. One of the four tall broadcasting towers had escaped our bombardment and was in our service. Two large Diesel engines of Swedish manu-

facture had been captured; one of them had a bent shaft but the other, in perfect condition, had been set up on Roi where it was generating all the electric power that was needed for both Roi and Allen Island. The Seabees had cleared nearly every foot of Roi and Namur and turned it to some use.

Eleven seriously ill patients were received from the beach 19 February. The next morning we sailed and at noon on 21 February we were traversing the deep entrance to Eniwetok Atoll, a passage which, we subsequently learned, had just been cleared of the biggest aggregation of enemy mines which had yet been encountered. As we passed between Japtan and Parry Islands, several of the nurses were waving from the fantail at the Marines who could be seen in the distance moving about the waterfront of the two islands. But there was not an answering wave from the troops, most unorthodox behavior; in fact the Marine Corps had never been known to show such lack of interest. Hardly had we anchored when destroyers and a heavy cruiser opened fire on adjacent Parry Island. The facts were that Marine troops had handily captured Engebi Island at the northern end of the atoll earlier in the week against light resistance. Our troops had landed on Parry Island 20 February and had taken over half the ground when a fierce counterattack supported by artillery had driven them back nearly to the sand pits at the extremity of the island.

An hour before sunset there was a sharp air raid by our carrier planes. After darkness fell the island was illuminated by Star shells and the bombardment kept on through the night. The morning of 22 February, groups of Marines from transports near us started going ashore in landing craft. The *Solace* was moved to a new anchorage about 200 yards from the beachhead and we soon began receiving patients brought by Ducks and LCVP's. These were literally fresh casualties. They came aboard covered with red dust, their clothing soaked with blood, with battle dressings over their wounds. Many of them were deep in shock and looked as if they might not live long enough to be moved off the quarterdeck. It was at once apparent that we needed facilities to give immediate treatment to this class of patients. Therefore, the senior medical officer directed that the large dressing room of the urology ward just off the quarterdeck and the eye, ear, nose, and throat operating room should be manned for use as resuscitation rooms. A medical officer was on duty, plasma was kept on hand in solution and several pints of "O" type blood were drawn from our ship's company and kept in nearby refrigerators. The use of this emergency treatment without question saved a number of lives.

We had recognized from the beginning what fine results were being attained by medical officers on the attack transports. Now we learned how many hours of hard work it takes to care properly for fresh casualties. And our appreciation rose still higher in step with the better understanding we were deriving from personal experience.

The majority of wounds in this action were from shrapnel, the result of hand grenades and mortar fire, methods with which the Japanese were quite efficient. A number of shattered legs and feet came from the explosions of land mines. We loaded 431 patients in addition to the 11 admitted at Roi. On 24 February the island was declared secured and the ship was ordered to depart.

The return trip saw every member of the medical department occupied with work till we were docked at Pearl Harbor 3 March. Nineteen patients died while we were at Eniwetok and during the return voyage, a mortality rate of 4.4 percent. Our patients were transferred to Base Hospital No. 8 and Aiea Heights Hospital.

It had become apparent that the mission of the *Solace* had been changed. We were being sent regularly to the combat zone. Maybe, as a result of unforeseen circumstances, we did reach Eniwetok at an earlier stage of the engagement than was originally planned. But we thought we had been able to do a better job because of being on the spot while the fighting was still in progress and before there had been time to establish medical facilities ashore. And we believed that we had a little more to offer in a medical way than the transports, with our nurses, our larger number of hospital corpsmen and doctors, our fine laboratories, x-ray department, and our more ample medical spaces. We looked upon the hospital ship as a necessary feature at the start of an amphibious operation, to be there when the first troops hit the beach, not exactly as an ambulance ship. We liked to believe that we could do something resembling the work of the shore hospital with the fortunate chance of being able to do it sooner.

These matters had, of course, been discussed by other men long ago. Naturally the senior medical officer had been entertaining such ideas. Early in the year he had sent to the Bureau of Medicine and Surgery, Navy Department, plans for increasing the number of surgical beds. When we arrived from Eniwetok official approval of his plans was waiting. Work was started at once removing the bulkheads in the four isolation wards on the main deck aft of the grand staircase. From this space emerged a fine surgical ward of 52 beds, a large operating room, a sterilizing and storage room and space still further aft in the old photographic department which served to house a portable x-ray unit. We had a little help from the yard in Pearl Harbor but the bulk of the work was done by our own ship's crew.

On 11 March we took our departure from Pearl Harbor for a different section of the Pacific. The ship was no longer a part of the Fifth Fleet; she was on loan to the Seventh Fleet.

A long voyage lay ahead and plans were made to spend the time profitably. Daily instruction for the hospital corpsmen was started. A class in Spanish was started, and our executive officer was persuaded to instruct a group of line and medical officers in the science of navigation; this interesting study was supplemented by a number of Navy training films which were aboard at the time.

On 15 March Davy Jones came aboard to notify the captain and crew that the *Solace* was now sailing through the domain of King Neptune and that on the morrow His Majesty would board the ship and deal properly with all pollywogs. We crossed the equator at its junction with the 180th meridian of longitude of 16 March. Due ceremonies were observed to the satisfaction of King Neptune and his retinue. By sundown the pollywogs had all become shellbacks.

We came to anchor in Espiritu Santo, New Hebrides, 19 March and remained in port for 6 days. The *Solace* was no stranger here, but the land was unknown to most of us and we proceeded to see as much of it as time and transportation permitted, with visits to Base Hospitals No. 5 and No. 6 included.

The ship left Espiritu Santo 25 March and sailed northeast through the Coral Sea. We passed through the China Straits 29 March and reached the anchorage at Milne Bay on the coast of New Guinea. The bay extends in an easterly direction and is bounded on the north and south by high mountain ranges. There is continual rainfall along the mountain tops and they cut off the bay from the prevailing winds. The air is hot, humid, and motionless.

We visited the Naval Dispensary at the head of the bay and the recently commissioned Base Hospital No. 13 at Hilamoi on the south shore. Roads into the jungle away from the beach were unimproved and impassable from mud. Several fishing parties met with fair success. Swimming was impossible because of the presence of sharks. The territory was under Australian military rule.

No objection was voiced when orders came for the ship to move 9 April. We dropped down the bay to a point opposite Hilamoi and loaded 173 medical and neuropsychiatric cases from Base Hospital No. 13. This time the scuttlebutt had been correct: we were headed for Australia. Once again we traveled the China Straits and the Coral Sea. We sailed up the Brisbane River and at 0930 on 14 April we tied up at Newstead Wharf in Brisbane. After some delay our patients were put ashore for transfer to Mobile Hospital No. 9, located on the outskirts of the city.

Brisbane is a city of more than a million inhabitants and is spread along both banks of the sinuous Brisbane River. Dim-out regulations were still in force and many of the streets in the business district were partially obstructed by air-raid shelters. Food and clothing were rationed and the manufacturing of jewelry was forbidden for the duration. There were several good hotels including the new and modern Lennon. Woolen goods and native semiprecious stones proved to be the best articles on sale.

A group of officers from the ship was able to spend a day at the city of Toowoomba in the mountains 90 miles back from the seacoast. A second group visited Surfers Paradise, an ocean resort. April is the Australian autumn; the air was sharp and invigorating after months spent in the Tropics.

We left Brisbane 18 April, following the groove we had made the week before. There was a stop the morning of the 20th at Milne Bay, but only for orders. We proceeded up the New Guinea coast and arrived at Buna 22 April. Here we anchored in the open roadstead off Sudest Beach and remained for 5 days.

Buna had been the scene of bitter fighting not so long before. Now the war had left it far behind. Most of our troops had already pulled out of the area. There was still a good deal of equipment lining the roads we had built back into the jungle.

We sailed from Buna 27 April, passing Gona, Lae, Salamaua, and other ports that were once enemy strongholds. We transited Dampier Strait and in the afternoon of 28 April reached Seeadler Harbor in the Admiralties. These islands had been attacked and captured by combined Army and Navy forces 2 months before. The harbor is a protected anchorage large enough for the entire fleet. In fact, a considerable proportion of the fleet was there when we arrived, more combat ships than we had ever before seen together. Before nightfall they all pulled out. Two airfields were already in use. The Navy headquarters was situated on Los Negros Island. Huge Manus Island was still largely populated by Japanese whom the Army was in the process of running down.

There had been no time to erect medical facilities ashore and the *Solace* remained in port for 8 days, acting as station ship. On 6 May the patients who were able to return to duty were put ashore and we sailed with the remainder. As we ran back along the coast of New Guinea we stopped for patients at Fincharbor and Buna. On 9 May we were again in Milne Bay, receiving patients from Base Hospital No. 13. These patients brought our census to 556.

There had been reasons to believe that our next disembarkation would be at Sydney. But our orders read otherwise; 12 May saw the *Solace* once more in Brisbane. We arrived and unloaded in the late

afternoon. That Saturday evening was spent in the city. Early the next morning we were riding the ebb tide down the Brisbane River.

On 16 May we stopped briefly at Milne Bay for routing. The next day we visited Langemak Bay, Finchaven, for patients. Another day and we were back at anchor in Seeadler Harbor.

Twelve days had brought important changes to this base. B-24's were flying from our new Mokerang Airfield. An Acorn Unit had finished half the buildings of a 250-bed hospital. New roads had appeared through the jungle under the magic wand of the construction battalions. The harbor contained many supply and repair ships.

We remained for 3 days in Seeadler Harbor, sailing 21 May. On successive days we stopped for patients at Finchaven, Buna, and Milne Bay, from whence we departed on 24 May. Once again we passed through the China straits. The ship arrived at Espiritu Santo 28 May and put ashore 181 patients.

So ended our brief period of service with the Seventh Fleet. We saw none of the fighting but we hauled a lot of patients. Now we were returning to the Fifth Fleet and to amphibious warfare with the Marines.

The *Solace* entered the Kwajalein Atoll 4 June and anchored off Roi Island. Commander Edward B. Peterson, USN, was awaiting the arrival of the ship, with orders to relieve our commanding officer, Commander C. L. Waters, USN. On 10 June with the ship's company assembled on the bridge deck, the command was changed; Captain Waters' pennant was pulled down and Captain Peterson's was run up to the masthead. Within a short time Captain Waters was piped over the side with cheers.

A sad misfortune overtook us during this stay at Roi. There were recreational facilities for the men ashore and regular liberty parties were sent from the ship. All the men were cautioned, on advice from the beach, not to swim on the ocean side of the reef. Four of our steward's mates broke this rule, either because they were overconfident or because they failed to get the word. They were caught in the heavy undertow. Although two of them were powerful men and expert swimmers, Stokes, Haines, and Bryant were drowned and Green, who luckily escaped, required resuscitation measures. Only one body was recovered.

We weighed anchor on 12 June and the 1-day trip to Eniwetok was made. We learned here that the *Relief* and the *Solace* were no longer the only two strictly Navy hospital ships in the Pacific theater of war. The U. S. S. *Bountiful*, AH9, formerly the *Henderson*, was at anchor in the lagoon. We were told that the U. S. S. *Samaritan*,



Figure 1.—The U. S. S. "Solace."

AH 10, once the U. S. S. *Chaumont*, was in the area and was assigned to the coming action.

Our first mail delivery for 7 weeks reached us at this port. Some of it had been generously treated with water. The letters had been on the way for a long time; part of them had undoubtedly been forwarded from Australia and had traveled many thousand miles by sea.

A medical staff conference was held. The subject for discussion was gas bacillus infection. Experience had led the surgical service to believe that all wounds of newly admitted patients must be viewed even though this entailed the removal of plaster casts which had been recently applied. The ship had just received an ample supply of penicillin and it was proposed to use this remedy liberally in all patients whose wounds were extensive. It was felt that the combined local and general administration of sulfonamides had not been of value in the prevention of anaerobic infection in wounds, since nearly all our patients with this type of infection had already received sulfonamides in adequate dosage. The use of antitoxin was debated. The customary small dose of 4,000 units of gas bacillus antitoxin plus 1,500 units of tetanus antitoxin as furnished for prophylactic use was held to be too small. The chief of surgery suggested that a

minimum of 20,000 units of combined antigas antitoxin be given to each patient whose wounds showed important damage to muscles. The value of early débridement was mentioned but it was concluded that we could not improve upon our present methods of treatment in this respect. It was further decided to take routine anaerobic cultures of extensive wounds for a time, provided the extra work did not prove to be more than the laboratory could handle.

In such fashion we laid plans for the new job ahead—the care of casualties resulting from the invasion of the Marianas. The *Bountiful* sailed the afternoon of 14 June. The *Solace* took her departure from Eniwetok 15 June. We passed the *Bountiful* early in the morning of 18 June, D-day plus 3, and at 0800 the ship had reached the point 30 miles north of the island of Saipan, as our orders had directed. We reported ourselves by several messages and proceeded, as we were told to do, to the anchorage off the west shore of Saipan, the first hospital ship to arrive. Our assigned berthing area was found to be among transports, repair ships, cruisers, and destroyers. We were nearly opposite the town of Charan Kanoa, which was under attack. The *Bountiful* followed us to the anchorage and both ships began at once to load patients brought from the beach by landing craft.

At 1700 there was an air-raid alert and enemy planes were over the anchorage. Two Japanese planes were shot down; none of our ships was hit. The *Solace* pulled up anchor following the air raid and thereafter we kept underway but for most of the time with no way on.

On 19 June a patient's duty party was sent to the beach; these were men who had been exhausted from lack of food and sleep and others with minor wounds. In the afternoon we transferred to the *Bountiful* enough patients to complete her loading and she left the scene of action. On 20 June we had on board 581 patients. Together with the 181 men who made up the duty party and the transfers to the *Bountiful*, this was a total of 762 patients admitted to the *Solace* in a little more than 2 days. The fighting continued heavy and it was plain that we would be needed back in the area as soon as possible.

We sailed early in the afternoon of 20 June. The course given us on this trip came within 30 miles of the Japanese island of Ponape in the eastern Carolines. The *Solace* arrived at Guadalcanal and was docked at 1600 on 26 June. Marine Corps patients were sent to United States Naval Fleet Hospital No. 108. Sixty-eight Army enlisted men and five officers were divided among four Army hospitals.

The debarkation was concluded at 1830. The mooring lines were cast off at once and the ship proceeded through the gathering dusk to the island of Tulagi. Here we took on fuel; supplies and medical stores were loaded throughout the night. At daybreak 27 June we sailed again for Saipan. There was no wasted time on this voyage or during the hours spent in port.

Once more we threaded our way at high speed along the east coast of the hostile Carolines. The medical spaces were cleaned and readied for action. A meeting of the medical staff was called by the senior medical officer for the purpose of discussing our recent load of patients. Our losses had been heavy although they were not quite as great as at the Eniwetok operation. Plasma and blood had been used whenever it seemed indicated. Members of our own ship's company served as donors for the transfusions and this necessitated a certain amount of delay while blood of the donor and the patient were cross-matched. It had been found that the blood type had occasionally been incorrectly recorded on patients' identification tags and cross-matching was held to be essential except in the face of grave emergency. It was noted with satisfaction that only two cases of gas bacillus infection had been encountered during the 6-day evacuation run.

The *Solace* reached Saipan for the second time the morning of 2 July. It was evident that our troops had been making good progress. The air field was in our hands and it was in operation. Mt. Tapatchu had been taken. Two batteries of 155-mm. artillery had been installed south of Charan Kanoa, one firing on the north end of the island and the other trained on Tinian Island across the strait. We lay to off the town of Garapan, where fighting was in progress. Both the *Relief* and the *Samaritan* had left, each with a load of patients.

In 3 days we had 573 patients. On 5 July we were ordered to depart for the Russell Islands. This time our course was more to the east of the enemy-held Carolines. This load of patients, like the previous one, contained many serious and critical cases. The 6-day run was none too long to accomplish the work which needed to be done.

The *Solace* reached the harbor off Benita Islands in the Russells at 1600 on 11 July. There was no dock with deep water, so the ship was anchored in the stream and the patients were put ashore by means of our own launches and landing craft from the nearby naval operating base. Army patients were sent to Army Station Hospital No. 222 and the Marine Corps personnel to United States Fleet Hospital No. 110.

One day of availability was granted to us and those who could be spared from the ship spent the time ashore. The Russell Islands made a very favorable impression. The terrain is rolling and the hills are wooded. Accustomed as we had become to the appearance of atolls which had been heavily bombarded with many of the small islands devoid of all growth but a fringe of coconut palms, the hardwood growth, the flowers and the singing birds that we saw here gave the impression of an entirely different and more pleasant land.

Fleet Hospital No. 110 was favorably situated on a high, cool ridge overlooking the water. The wards were of Dallas hut construction



Figure 2.—A hospital corpsman giving a transfusion aboard an LCVP as he awaits transfer of his patients to the U. S. S. "Solace."

but with the addition of extra windows and screened spaces for ventilation. The quarters, mess hall, and officers' club were very attractive and the grounds were pleasingly landscaped. Enough trees have been saved to provide adequate shade.

The ship sailed the next morning, 13 July, for Eniwetok to await further orders. A conference of medical officers was called 14 July. During the two Saipan runs, 1,335 patients had been admitted to the *Solace*; 1,264 of these were battle casualties. The total number of deaths was 37. This is an over-all mortality rate of 2.7 percent and a rate of 2.9 percent if wounded men alone are considered. These figures compared favorably with the rates of 4.4 percent and 4.7 percent from the Eniwetok assault, the only previous instance in which we had admitted a considerable number of casualties directly from the beach.

The consideration of anaerobic infections showed a disappointing contrast between the two evacuations. It will be recalled that before the start of the Saipan invasion, the medical staff had decided to use penicillin and larger amounts of gas gangrene antitoxin as prophylactic measures. There were only two instances of gas bacillus infection on the first Saipan trip; while on the second trip, with precisely the same prophylaxis, we were called upon to treat 18 patients with gas infection. A much larger number of patients on our second trip had gas-producing organisms in their wounds. The first load of patients was at the beginning of the action when the troops were fighting on the beach. By the time of our second arrival the fighting had extended into the farming land on the hill sides. The Japanese had ruled Saipan for 25 years, all the available land was under cultivation and without doubt it was fertilized as usual by the use of night soil.

The matter of blood transfusions demanded immediate consideration. Heretofore we had counted on using our ship's company as donors. Now everyone had given blood in the last few weeks, some persons more than once. It was deemed inadvisable to use any of the donors again within 3 months. The senior medical officer decided to secure blood, if possible, at Eniwetok and to attempt to transport it to the forward area.

We arrived at Eniwetok 19 July and learned that we were to stay for 2 days. This gave us the opportunity to see the islands at the south end of the atoll; we were anchored but a short distance from the spot we had occupied the first time we saw this country. Then the islands were quite pretty. Now it was a different picture. Many of the coconut trees on Parry and Eniwetok Islands had been ruined by our bombardment and many more had been removed to make way for a new airfield and our other military installations. We had converted the islands to our own uses but they had been reduced to barren strands of coral sand, worthless for any other purpose. Japtan Island alone had escaped devastation; it was used by Graves Registration as a burial ground.

The senior medical officer had sent out a call for blood donor volunteers and 100 Marines came aboard the ship 20 July. Thus 100 pints of blood were obtained and placed in refrigeration. We learned by experience that if the blood was stored in the part of the ship where vibration was at a minimum, it could be kept for about 5 days of cruising before hemolysis began.

The ship sailed from Eniwetok at 0800 on 21 July and arrived at the island of Guam on 24 July, which was D-day plus 3. We lay to off the west coast to the north of Cabras Island and began loading patients at once.

At 0635 on 25 July the *Solace* was drifting slowly about 1,000 yards from the shore and opposite a Marine tent hospital. The tents were set up at the base of a deep gully cut into the steep hillside. Suddenly shots rang out and shells began to fall about the *Solace*. The Navigator had the watch on the bridge and he had the ship underway in a few seconds time. Several more shells fell in our wake but the ship escaped unharmed.

After the island was finally secured we heard from the senior medical officer of the Marine hospital the details of this engagement. The Japanese had evidently been working down the ravine during the night. The doctor had become sure of this fact in the early morning and had just notified the Command Post when the enemy made the last of the intervening ground on the run, killed the sentry and reached the rear tent of the hospital before they were killed by the Marines' fire. None of the patients was injured. Several mortar shells exploded about the hospital and it was believed that it was mortar fire to which the *Solace* had been subjected.

On 26 July the ship was ordered to proceed with her 581 patients to Kwajalein, from whence the evacuation of patients was to be continued by air. The voyage required 4 days. The ship reached Kwajalein late in the afternoon of 30 July and patients were transferred ashore at once. Blood was collected from volunteer donors.

We took departure from Kwajalein early the following morning and arrived at Guam for the second time 4 August. Agaña had been captured from the enemy. Heavy artillery had been located in the hills above and north of Agaña and was firing upon the retreating Japanese forces. The Marine medical battalion was making use of the new pavilion and the Hospital Corps quarters of the old naval hospital in Agaña. They were the only two buildings on the hospital reservation which had stood throughout bombardment.

The *Solace* lay to as before off the reef and loaded patients at a less rapid rate. The ocean bottom falls away abruptly outside the reef and in order to anchor it is necessary to approach the shore quite closely. Permission to do this was granted as soon as organized resistance on the island had ceased. We anchored off the harbor of Agaña in company with an ammunition ship, a convenient arrangement in some respects. Ducks bringing patients came down to the beach and lumberingly took to the water. Sitting with the driver would be a Chamorro boy with a campaign hat, chewing gum. After our stretcher bearers had taken the patients aboard the ship, the Duck pulled along side the ammunition ship, was loaded with shells, and proceeded again to the hills. It was a businesslike and somewhat incongruous combination of duties which this type of vehicle or craft was eminently qualified to perform.

Embarkation of patients had dropped in pace and officers, even nurses, were able to go ashore. We saw Agaña and its environs, the old hospital with its two remaining buildings occupied by Marine patients, and with five-tent wards set up on cement tennis courts. Some of us were fortunate enough to be able to visit Apra Harbor and a portion of the high ridge behind the shore line.

Tent hospitals for the native population and for Japanese civilians were functioning under Military Affairs. The physicians working in these were naval medical officers. Martinez, the Captain's steward, a Chamorro boy himself, found his family living in the country and already planning to rebuild their home in Agaña.

On 15 August, with a patient census of 419, the ship was ordered to leave for Pearl Harbor.

We stopped briefly at Eniwetok for fuel on 26 August and arrived in Pearl Harbor 1 September. Our patients were transferred and the ship was ready for dry dock.

The two evacuations from Guam had produced a total of 1,067 admissions to the ship, 885 of which were in key letter "K" classification. There were 26 deaths in all, giving a mortality rate of 2.9 percent of battle casualties or 2.4 percent of all admissions. The plan of securing blood donors in the advanced area had provided a blood bank which had cared for our transfusion needs during the Guam operation.



EDITORIALS



MISSION OF MEDICAL DEPARTMENT, U. S. NAVY

The mission of the Medical Department of the Navy is THE PREVENTION OF DISEASE AND THE CARE OF THE SICK AND INJURED OF THE NAVY AND MARINE CORPS IN PEACE AND WAR.

This includes the medical care of all officers and men of the Navy and Marine Corps and their dependents in all parts of the world, the emergency treatment of civilian workmen employed by the Navy, and the care of native populations of the mandated areas. There are some other smaller groups provided with medical care but these are the principal ones. An important part of this medical service includes not only the treatment but the prevention of disease.

This mission has been graphically expressed by the eminent naval hygienist J. D. Gatewood in the phrase: "TO KEEP AS MANY MEN AT AS MANY GUNS AS MANY DAYS AS POSSIBLE."

In reference to the mission of the Medical Department, other naval medical authors have provided some interesting definitions. Rear Admiral A. Farenholt (MC) USN, states, "The Naval surgeon's primary duty on board ship is keeping the health of the personnel up to the highest state of efficiency, arranging for the care of the wounded in, and more particularly immediately after, action." H. E. R. Stephens, a British naval surgeon, said, "The first duty of the surgeon of the ship is to render the ship an efficient fighting unit as far as lies in his power."

In general, the mission of a military medical department can be expressed as follows:

(a) *Procurement of manpower*.—Recruiting of those physically qualified for military duties.

(b) *Promotion of physical power*.—Augmentation of health by hygienic measures.

(c) *Prevention of diminution of physical efficiency*.—Sanitation and disease prevention.

(d) *Restoration of physical power*.—Treatment of disease and injuries—hospitalization and procurement and distribution of medical and surgical supplies and equipment.

(e) *Separation from fighting forces of physical ineffectives.*—Evacuation of disabled (primarily a wartime measure); evaluation of physical disability; discharge or retirement if disability is permanent.



NEW PATHS IN THE TREATMENT OF LEPROSY

A number of drugs derived from diaminodiphenylsulfone have been used in recent years in the treatment of leprosy and represent the most significant advance since the use of chaulmoogra oil or its derivatives. These sulfone drugs, some of which are promin, diasone, promizole, and sulphetrone have been used now with considerable success in the lepromatous or severe types of leprosy which other drugs have not proved to be of much value. Sulphetrone is the latest of this class of drugs. Destruction of red cells and resulting anemia is the most untoward effect of this medication and the blood picture should be closely watched. Allergic dermatitis, leukopenia, headaches, and nausea are other manifestations to be noted.

Where an adequate dosage is attained, results in advanced cases are often remarkable. There appears to be an arrest of the disease with healing of open lesions. There is a marked reduction too in the number of bacilli in smears and skin sections. It is not to be presumed from this that a cure for leprosy has been found. It will take many years before complete evaluation of this treatment can be made. The sulfones do however offer a most encouraging prospect for the cure of this disease.



DROWNING IN SALT AND FRESH WATER

Recent work for the Medical Branch of the Physiology Laboratory of the University of Texas shows that in drowning in salt water there is concentration of the blood, and in drowning in fresh water there is rapid blood dilution. These produce important cardiac and biochemical effects as shown in a paper published by Swann, Brucer, Moore, and Vezien in Texas Reports of Biology and Medicine, No. 5, 1947. They find that, while ventricular fibrillation occurred in from 3 to 5 minutes of submersion in fresh water, no cases showed fibrillation in salt water, and the cardiac function was maintained for nearly twice the length of time in salt water as in fresh water.

This is an important matter to the naval surgeon for drowning is one of the special hazards of nautical life. That efforts for resuscitation of the apparently drowned are more likely to be successful in cases of submersion in salt water is very evident. The difference in prognosis in apparent drowning in fresh and salt water is a significant and important matter.



THE TRUTH ABOUT MARIHUANA

So many popular and often hysterical accounts of marihuana and its effects and dangers have appeared in the last twenty or more years, that it is perhaps well to review the sober, scientific facts at present.

Cannabis is a powerful drug, classed as a narcotic with action particularly on the higher nerve centers. Euphoria and an exaltation of the imagination over the other faculties, and visual hallucinations, particularly of geometric objects are characteristic. Perhaps its most remarkable effect is that of prolonging the sense of time. It has long been used in the Orient, and in large doses may produce an active delirium. In toxic doses, it produces a descending depression of the nervous system in much the same way as does alcohol. Indeed its general effect of producing euphoria and increased psychomotor activity followed by depression is similar to alcohol. It produces, however, a greater amount of disorientation and its exaggeration of the sense of time is peculiar to cannabis. As a therapeutic agent, it has not been found of much value although the USP XI contained an extract with a dose of $\frac{1}{4}$ grain and a fluid extract with a dose of $1\frac{1}{2}$ minims. About the only use has been as a coloring agent in corn remedies and also it has been suggested in depressive mental states.

On the other hand, there is no evidence that the drug produces insanity. No evidence of brain damage has been shown. It is not a sexual stimulant. It probably does not lead to criminal acts any more than any other drug, alcohol for instance, that results in a lessening of inhibitions. There is no real evidence that delinquency or antisocial behavior is primarily due to the drug. This idea is popular as an excuse for crime but there is no evidence that the drug *per se* can cause any mentally normal and socially adjusted person to commit a criminal act. There is also no real evidence that this drug produces physical dependence on it to such an extent as to cause addiction as is the case with opium, or to some extent, with as commonly used a thing as tobacco. It is habit-forming only in the sense that a great many acts

and usages are habit-forming, such as getting up at 6 o'clock in the morning or drinking coffee.



THE HISTORY OF THE HEALTH RECORD

The health record used by the Navy, or "Form H" as it is known, was officially adopted for use on 1 January 1911. However, it was introduced gradually by making health records on all officers, and men at enlistment or re-enlistment, as admitted to the sick list, vaccinated, or in other routine contacts with the Medical Department. Thus, without too great a burden of physical examination and clerical work at one time, the health record came into existence for all naval personnel. The record itself, which is not much altered over 37 years, was a loose-leaf booklet 10 inches long and 4½ inches wide. In addition, the physical examination sheet, one for marks and scars, vaccination record, and medical abstract, were parts of the original record, as well as blank sheets for *concise* accounts of the medical history. With the exception of the dental sheet and a special page for syphilitic cases, the record today is pretty much as originally adopted.

In nearly four decades and two major wars, this simple and compact medical history "from cradle to the grave" has proved to be of inestimable value. Because of its small size, convenient shape, the completeness of useful information on the individual's medical history, and the brevity of entries, it has proved to be one of the most valuable contributions made by the Medical Department to efficiency in the handling of naval sick and wounded. Many doctors in our Reserve thought it the best thing they had ever seen in medical record keeping, and a number have stated they intended to use it for regular patients in their civilian practice.

Formerly, officer health records had a green cover and were officially known as "Form H, Green." This simple distinguishing color was very convenient and timesaving in the handling of records, and consideration might be given to the restoration of this distinction.

The Health Record was adopted by the Navy in the regime of Surgeon General Stokes, who developed the Stokes stretcher, another invaluable development of naval medicine, and used in some form by every navy and merchant marine in the world for handling sick and wounded on board ship, between ships, ships and boats, and ships and shore. The original idea of the Health Record Form was conceived in 1905 apparently by then Chief Pharmacist's Mate, afterwards

Chief Pharmacist, C. E. Alexander. Commander Francis M. Furlong (MC) USN, then in charge of Records in the Bureau of Medicine and Surgery, began work to improve the Medical Record of the individual. In a letter addressed to Captain W. E. Eaton (MC) USN, he describes the difficulties with medical records at that time.

"In those days getting out a history of an officer or man was very laborious. First a service record had to be obtained from the then Bureau of Navigation. The various ships and shore stations, with dates, where the man had served were listed; then the medical journal of the various ships and shore stations were assembled and searched for entries. If the officer or man had been a patient in naval hospitals, the case papers and hospital tickets were added. Without exaggeration, I have observed piles of medical journals 1 to 2 feet high for one case!

"In the fall of 1905 Fleet Surgeon I. Lloyd Thomas, R. N., visited the Bureau. I had previously met him in Hong Kong. When he saw our work gathering medical data, he exclaimed 'We do this better in the British Navy.' He said they had an individual health record which accompanied a sailor or marine from ship to ship. He said he would send me one on his return to England, which he did. On its receipt, I went to work on an individual, continuous health record designed to accompany or follow officers and enlisted men throughout their naval service.

"At the same time, I went to work with a view of simplifying the hospital (admission) ticket. In those days, the latter was a cumbersome form. It consisted of data taken from the patient's enlistment record and medical journal. It was about 8 by 12 inches and was very irksome and time-consuming to prepare. Much of the data asked for was repetitious. I had noticed, while in the Bureau, that the hospital tickets used during the Civil War were very simple and small. This I recommended in place of the old hospital ticket and to be used with the proposed health record."

Admiral Rixey was Surgeon General during this period and the ideas were further studied and developed in his regime. Admiral Rixey was one of our most forward-looking naval medical administrators. The U. S. Naval Medical School, the *U. S. Naval Medical Bulletin*, the beginning of postgraduate education in civilian institutions, Hospital Corps schools, naval medical supply depots, the Nurse Corps, the inception of the Dental Corps, and the command of hospital ships by medical officers were the results of his farsighted planning. The naval hospitals at Bremerton, Wash.; Canacao, P. I.; Guam; Great Lakes, Ill.; and the Las Animas, Colo., for tuberculosis cases were built under his direction. Though actually put into effect by Surgeon General Stokes, Admiral Rixey was also responsible for putting our

admirable Health Record into use in the Navy. Chief Pharmacist Alexander, Doctor Furlong, Fleet Surgeon Thomas, of the Royal Navy, Mr. Worth, a civilian clerk in the Record Room of the Bureau of Medicine and Surgery in the early 1900's, and a number of medical officers on duty in the Bureau between 1905 and 1911 took part in its development.



MEDICAL AND DENTAL OFFICERS

*Whose Deaths Have Been Reported Since
the Last Issue of the Bulletin*

CONNELLY, JAMES HOBAN, Commander (DC) U. S. N.
(Retired, Inactive). Died 13 May 1948 at U. S. Naval
Hospital, Bethesda, Md.

HARRAL, PICKNEY (N), Lieutenant (MC) U. S. N. R.
(Retired, Inactive). Died 4 January 1948 at Southside
Hospital, Mesa, Ariz.

PHELPS, JOSEPH ROYAL, Captain (MC) U. S. N. (Retired,
Inactive). Died 8 May 1948 at U. S. Naval Hospital,
Long Beach, Calif.

CLINICAL NOTES



TOTAL CYSTECTOMY WITH BILATERAL URETEROSIGMOIDOSTOMY FOR CARCINOMA OF THE BLADDER

CLIFFORD F. STOREY

Captain (MC) U. S. N.

and

A. T. TALLEY, Jr.

Lieutenant, junior grade (MC) U. S. N. R.

Naval medical statistics indicate that the operation of total cystectomy with bilateral uretero-intestinal transplantation is an operation infrequently performed in the Navy. Transplantation of the ureters into the distal large bowel may be indicated for numerous reasons, the more important being exstrophy of the bladder, vesicovaginal fistula following irradiation for carcinoma of the cervix, and carcinoma of the bladder involving the trigonal area. This paper will be confined to a brief discussion of the treatment of bladder carcinoma with the report of a case treated by bilateral ureterosigmoidostomy and total cystectomy.

Several methods are available for the treatment of carcinoma of the bladder and the choice selected depends upon the type and location of the tumor, the general condition of the patient, and the experience and preference of the urologist. Cystoscopic fulguration may be used advantageously for pedunculated tumors which show no evidence of infiltration. More extensive papillomatous lesions require suprapubic cystotomy with removal of the tumor by cautery, snare, or fulguration. In such cases, the use of radium postoperatively is frequently indicated. For tumors of the lateral wall or vault, local resection is simple and effective. Counseller (1) has recommended transvesical electrocoagulation for treating growths of the infiltrating type confined to the base of the bladder and considered nonresectable. Barringer (2) is of the opinion that radon implants are superior to diathermy in lesions of this type. Finally, Beer (3) (4), Quinby (5), Hinman (6), and others favor total cystectomy as the operation of choice when the trigone and ureterovesical junction are invaded by carcinomata.

The difficulties attendant upon surgery of the bladder are readily apparent when it is realized that 80 percent of vesical tumors involve the most inaccessible portion of the organ, namely the base. Barringer (2) reports that 177 of a total of 228 cases of bladder carcinomata were situated close the urethra or at one or both ureteral orifices. Fortunately, these lesions frequently remain localized until quite late and distant metastases are uncommon.

There is considerable difference of opinion as to whether total cystectomy with bilateral uretero-intestinal implantation is justified in the presence of local extension of the lesion. This operation has, according to various authors (7) (8), a mortality rate of between 30 and 60 percent in the one-stage procedure. However, with the advent of the two- and even three-stage operation, the mortality rate has been markedly reduced. If this procedure can be performed with a reasonable mortality rate, it is felt that no patient should be refused the relief of total cystectomy unless there is evidence of metastases to the lungs, liver, or spine. Quinby (4), in discussing the indications and technique of total cystectomy at the Peter Bent Brigham Hospital, makes the following statement:

From experience with these patients, especially when comparing their post-operative careers with those whose bladder carcinoma has been treated by radium or various combinations of radium and partial excision, I cannot but feel that total cystectomy should be employed more often than has been done in the past in our fight against vesical carcinoma.

The main problem confronting surgeons doing this operation has been the disposition of the ureters. Due to the primary condition, there has usually been some dilatation and injury to the ureters and kidneys, and the mortalities encountered during the first stage of the two- or three-stage operation are usually due to ascending infection of the dilated ureters with a subsequent overwhelming pyelonephritis. These catastrophies can be obviated to some extent by adequate pre-operative treatment to eliminate any infection present in the kidneys by the aid of catheter drainage and chemotherapy, by measures to improve the general condition of the patient, by proper preparation of the ureters and bowel for the contemplated anastomosis, and by the use of the Coffey I operation or some modification of the valve principle to avoid ascending infection. The ureters have been transplanted into the sigmoid intraperitoneally, into the rectum extraperitoneally, into loops of intestine separated from the intestinal tract, such as an excluded loop of sigmoid, an artificial anus having been made in the upper sigmoid. They have been transplanted to the skin, either by lumbar or iliac ureterostomy, into the urethra and the vagina, and the urine has likewise been deflected by lumbar nephrostomy. The prevailing opinion among urologists seems to

favor transperitoneal transplantation of the ureters to the distal large bowel, although Beer (3) and others prefer iliac ureterostomy.

CASE REPORT

A white male, 57 years of age, was admitted to the U. S. Naval Hospital, Corpus Christi, Tex., on 30 April 1946 with the chief complaint of hematuria. His illness began in October 1945 with dull aching low back pain and malaise. He soon developed terminal burning on urination, frequency, and nocturia. Hematuria was first observed in December 1945. His local physician made a clinical diagnosis of calculus of the urinary tract and medical treatment was instituted. However, he continued to pass bright red blood with occasional dark clots in the urine and lost 10 pounds in weight. His attending physician referred him to this activity on the date indicated for study and treatment. The past history was not relevant.

On physical examination he appeared to be chronically ill. He stated usual weight was 150 pounds, and on admission he weighed 140 pounds. The blood pressure was 140/100, temperature 98.6° F., pulse rate 74, and respiration 18. The physical examination was essentially negative except for slight symmetrical enlargement of the prostate gland. That organ was smooth in contour and was not tender. His urine analysis showed 4+ albumin, no sugar, and the urine was loaded with red blood cells. The red blood count was 4,700,000, hemoglobin 13 grams, and there were 15,500 white blood cells per cubic millimeter with an essentially normal differential count. The Kahn test was negative. The blood nonprotein nitrogen was 34 milligrams percent. Subsequent investigation showed the two-glass urine test to contain numerous red blood cells in the first glass and gross blood in the second glass. The chest x-ray was negative. The pelvis and spine showed no bony pathology on radiographic examination. Cystoscopy revealed a very extensive infiltrating growth in the right lower half of the bladder involving the right ureteral orifice and extending well across the bladder trigone. The growth was biopsied and microscopic examination established the diagnosis of papillary carcinoma of the bladder. An intravenous pyelogram revealed some enlargement of the right kidney with fairly marked dilatation of the pelvis and calices, and function on that side showed marked impairment. (See fig. 1.) The left pelvis and calices were normal and the left ureter showed no dilatation. There was no evidence of a renal calculus. A cystogram demonstrated considerable irregularity of the right side of the bladder, due to the space-filling tumor.

The patient was placed on a high-caloric, high-vitamin diet, penicillin 40,000 units every 3 hours, and sulfasuxidine 12 grams daily. A left ureterosigmoidostomy was done on 12 June 1946, employing the Coffey I technique. Although it is generally preferable to transplant the right ureter first for anatomical reasons, the left ureter was transplanted primarily in this case because it was not certain at the time that the right ureter would not have to be sacrificed due to the extension of the malignancy which surrounded the right ureteral orifice; and furthermore, it was desired to have the unimpaired left kidney functioning properly through the bowel at the time of the second stage of the operation.

The abdominal examination at operation revealed no local extension of the carcinoma either to the serosa or the tributary lymph glands. A midline suprapubic abdominal incision was used and the left ureter was exposed by opening the peritoneum on the left lateral pelvic wall. It was freed carefully down to the ureterovesical junction. Double clamps were applied at this point and the ureter was severed between them, the distal segment being doubly ligated immediately adjacent to the bladder with chromic catgut. The ureter was freed

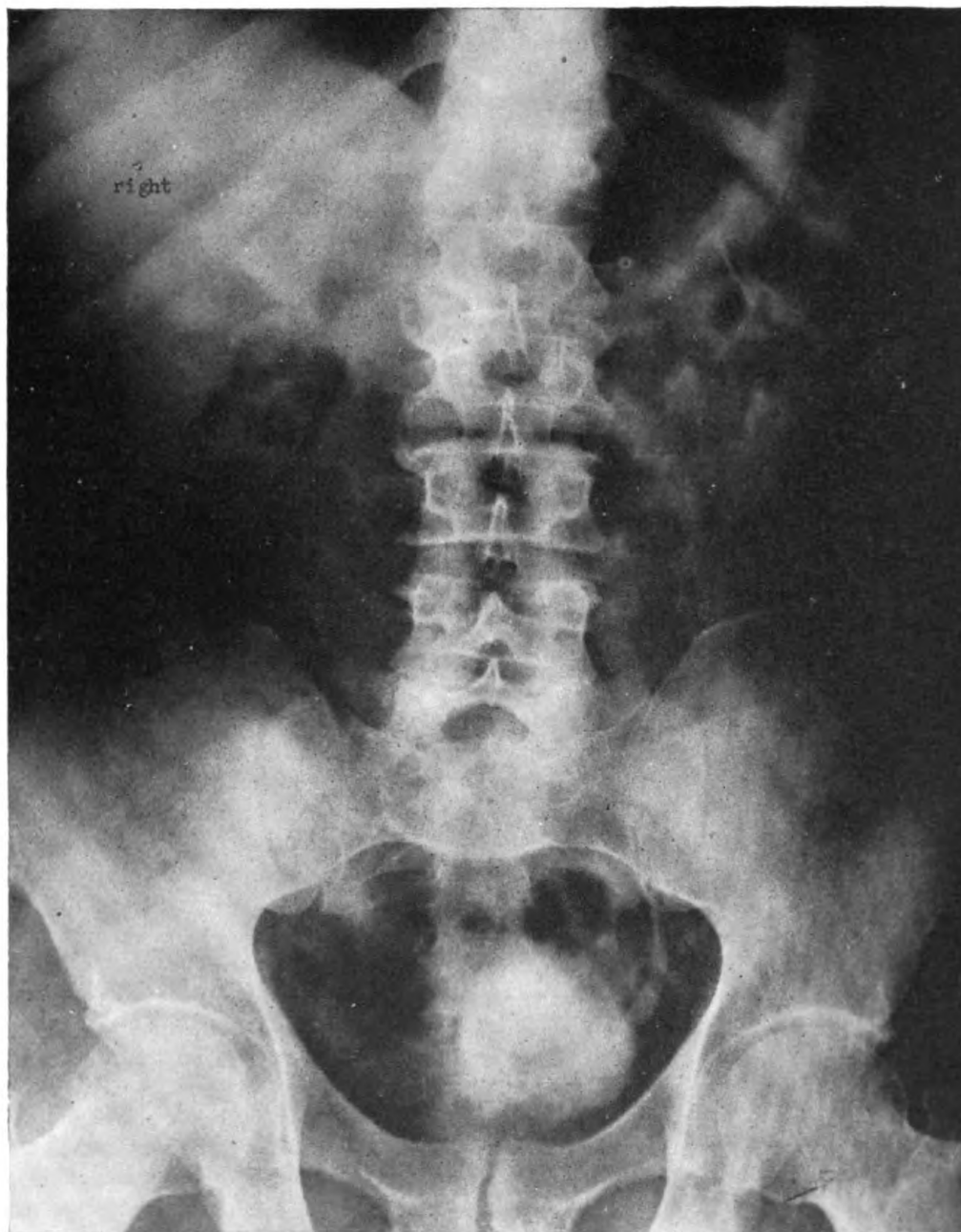


Figure 1.—Preoperative intravenous pyelogram, 30-minute film, taken on 4 May 1946. The 5-minute film had shown prompt appearance of the dye in the left kidney but none in the right. There was excellent visualization of the left pelvis, calices, and ureter in the 10-minute film, but the right renal pelvis could only be faintly seen. In this view, taken at 30 minutes, it will be noted that the left renal pelvis has emptied, but there is marked retention of the dye on the right side. There is bulbous dilatation of the calices and a large filling defect occupying almost the entire right lateral half of the bladder.

sufficiently high to allow anastomosis with the colon without kinking or tension. The gut wall was then incised along a taenia down to the mucosa for a distance of approximately 5 cms., forming a gutter in which to place the ureter. Care was exercised not to perforate the mucosa. Since this ureter was slightly dilated the gutter was made correspondingly large by gentle separation of the mucosa for a considerable distance on either side of the incision. The tip of the ureter was then cut on a bevel just proximal to the clamp with which it was held, and an atraumatic chromic No. 00 catgut suture passed through the tip of the beveled ureter. Spillage of urine was prevented by an artery clamp lightly applied to the ureter. The anterior wall of the sigmoid colon at the site where the trough had been created was tented by four Babcock clamps and the abdominal cavity protected by packing off this isolated loop of bowel with moist, warm laparotomy packs. A small perforation was then made in the mucosa at the inferior extremity of the gutter by a phenolized knife. The bowel was empty and there was no leakage. Each end of the suture secured to the end of the cut ureter was then carried through this opening into the bowel lumen and they were brought out about 2 mm. apart approximately 1 inch below the point of entrance. By taking up the slack on these sutures the tip of the ureter was brought into the lumen of the colon for a distance of approximately 1 inch and it was secured in position by loosely tying the sutures on the serosal surface of the sigmoid. The muscularis and serosa of the colon were then approximated over the ureter by interrupted atraumatic No. 00 chromic catgut sutures. Each suture caught a bit of adventitial tissue of the ureter to hold it in place, but great caution was exercised not to enter the ureteral lumen. A second layer of sutures of the same type was used to reinforce the first row, but at this time only the serosa was approximated. An appendices epiploica was sutured over the ureter at the point where it emerged from the bowel wall and all raw surfaces were reperitonealized in the manner described by Strode (9). There was no tension on the suture line and no constriction of the ureter. Catheters, as Coffey (10) and others have recommended, were not used.

The patient's postoperative course was complicated by the development of a superficial wound infection, but was otherwise uneventful and he shortly began passing three or four watery stools daily. An intravenous urogram on 25 June revealed the left renal pelvis to be normal, the left ureter unobstructed, and there was prompt appearance of the dye in the sigmoid colon. There was almost no function of the right kidney at this time, as evidenced by the urogram (fig. 2), and cystoscopic examination revealed the bladder to be almost completely filled by a fungating papillary carcinomatous growth. The bladder capacity was little more than 1 ounce and there was no urine being excreted by the right kidney. When blockage of the right ureteral orifice had become complete a day or two prior to this examination, the patient had developed chills and a marked febrile reaction.

The wound infection responded promptly to appropriate measures and on 26 June 1946 a right uretersigmoidostomy was done. Both a right uretero-intestinal transplantation and a total cystectomy had been contemplated at this stage, but the patient's general condition was so poor as the result of complete blockage of the right ureter, that he was closed after this ureter had been transplanted into the sigmoid. Again, a superficial low-grade wound infection supervened, but this cleared up rapidly under the usual therapy.

Total cystectomy was performed on 11 July. For the third time a midline vertical suprapubic incision was used, the previous scar being excised. This operation was performed extraperitoneally, the bladder reflection of the peri-

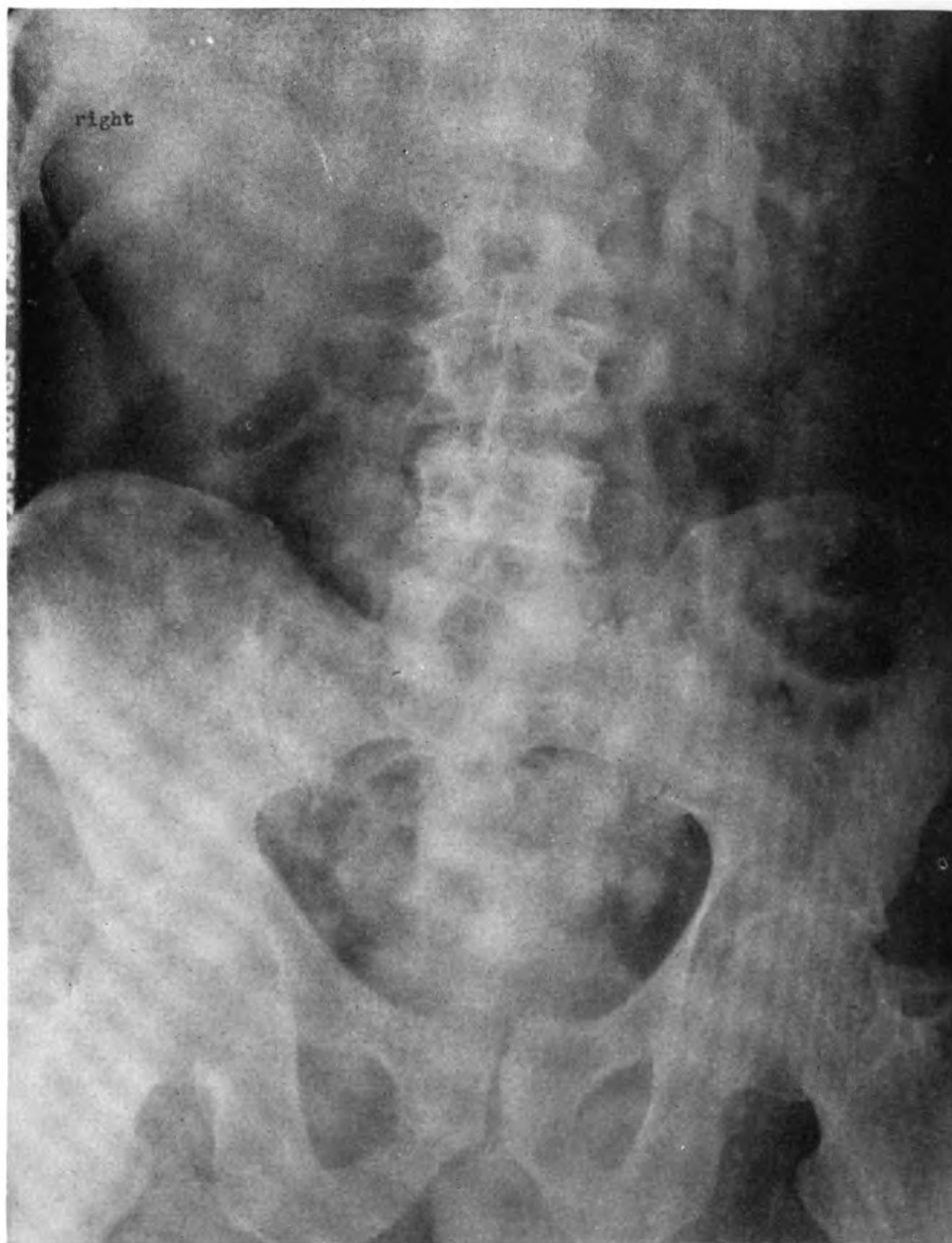


Figure 2.—Intravenous pyelogram after left uretersigmoidostomy, 30-minute film, taken on 25 June 1946. There was prompt appearance of the dye in the left pelvis, calices, and ureter in the 5-minute film. It will be seen that the dye passes readily into the sigmoid. Retention of dye after 30 minutes is present on the left. Note the absence of function on the right side. No dye could be seen on this side in any of the film.



Figure 3.—Intravenous pyelogram after bilateral ureterosigmoidostomy, hemi-prostatectomy, and total cystectomy, 5-minute film, taken on 22 July 1946. Note the sharp definition of the major and minor calices and pelvis, and the normal ureter on the left. The delay in emptying on the left side noted on 25 June is no longer present and the moderate dilatation of the calices, pelvis, and ureter on this side that had been present at that time has disappeared. The dye appeared promptly on the right side. In the 10- and 15-minute film the pelvis and calices on the right appeared normal, and the 30-minute film demonstrated satisfactory emptying on each side. The dye can again be seen in the sigmoid colon.

790689°—48—8

toneum being freed and retracted upward. It was felt that this approach was justified in view of the fact that careful inspection at the two preceding stages had shown no invasion or fixation of the vesical reflection of the peritoneum or other evidence of local extension of the bladder lesion. The bladder was thoroughly mobilized, the pubovesical ligaments being exposed and divided. By traction on one side, the lateral pedicle of the bladder was exposed and divided and the arteries ligated. The bladder was then swung in the opposite direction and the procedure repeated on the other side. Traction on the bladder in an upward direction then revealed the vesical neck and superior portion of the prostate gland, bringing that organ into relief very much as the uterine cervix is exposed by traction on the fundus uteri in the course of supravaginal hysterectomy. A doubled No. 2 chromic catgut suture on a large cutting needle was passed through the superior portion of the prostate gland in a posterior anterior direction. This suture was cut and one-half tied over each half of the prostate gland. This organ was then divided by a scalpel on the bladder side of the transfixion ligatures. Total cystectomy and hemiprostectomy was thus completed and the incision was closed in layers in the usual manner after a Penrose drain had been inserted in the vesical space.

Postoperative convalescence was entirely uneventful. By 3 August 1946 the bowels were well regulated. At approximately 0600 the patient had a watery stool followed by a well formed stool. Again about noon he passed a watery stool and subsequently around 2000 there was a third watery stool usually followed by a small well formed stool. There was an occasional watery stool around 2400, although ordinarily the patient was able to sleep throughout the night. There was no leakage of urine at any time nor did the patient experience any discomfort. An intravenous urogram on 22 July revealed a normal ureter, kidney pelvis, and calices on the left, and marked improvement of kidney function on the right (Fig. 3). The dye appeared promptly in the sigmoid.

The patient was discharged on 9 August 1946 and was seen in the out-patient clinic on 7 September 1946, at which time he had gained 19 pounds in weight and had no complaints. Shortly thereafter he returned to his usual occupation as a painter. When heard from on 1 March 1947, 9 months postoperatively, he was working regularly at his trade and was symptom-free. He had gained 26 pounds. This patient was very grateful for the relief furnished him and he has experienced neither inconvenience nor discomfort as a result of evacuating his urine per rectum.

The patient was seen again on 15 September 1947. He was 39 pounds above his preoperative weight and was symptom-free. He never has watery stools, bowel movements and the passage of urine per rectum being independent of each other. He has one, or occasionally two, formed stools daily. His urine is evacuated per rectum four to six times daily. He is now essentially free of nocturia, finding it necessary only on rare occasions to pass urine once during the night hours. He continues to work full time as a painter. Excretory urograms done in September 1947 showed good function with prompt appearance of the dye in both renal pelvises in the 6-minute film. His nonprotein nitrogen at that time was 32 mg. per centimeter.

SUMMARY

1. The treatment of bladder malignancies is briefly discussed.
2. A case of extensive papillary carcinoma of the bladder involving the right ureteral orifice and the entire trigonal area is reported.
3. The operative technique for a three-stage procedure for bilateral

ureterosigmoidostomy, total cystectomy, and hemiprostectomy is outlined.

CONCLUSIONS

Total cystectomy with bilateral transplantation of the ureters into the large bowel presents no particular technical difficulties. By the use of a two- or three-stage procedure and with proper preoperative preparation and postoperative care of the patient, it has been possible to reduce the mortality for this operation remarkably. Because of the characteristics of bladder carcinoma in general, the operation should be curative in a high percentage of carefully selected cases if done early and not after various other therapeutic measures have been tried and failed. The procedure appears to merit favorable consideration, even where local extension has occurred, because of the relief and comfort it affords the patient. In the opinion of the authors this operation merits more widespread popularity than it appears to enjoy at the present time.

REFERENCES

1. COUNSELLER, V. S., and BRAASCH, W. F.: Diathermy for carcinoma of bladder. *Ann. Surg.* **101**: 1418-1425, June 1935.
2. BARRINGER, B. S.: Tumors of the Bladder, *Practice of Surgery*, Dean Lewis. Volume VIII. W. F. Prior Company, Inc., Hagerstown, Md. Chap. 16, p. 32.
3. BEER, E.: Total cystectomy and partial prostatectomy for infiltrating carcinoma of neck of bladder; report of 8 operated cases. *Ann. Surg.* **90**: 864, Nov. 1920. Cited by Barringer (2).
4. BEER, E.: Symposium on carcinoma of bladder; surgery of bladder tumors. *Ann. Surg.* **101**: 1412-1415, June 1935.
5. QUINBY, E. H.: Quoted by Barringer (2).
6. HINMAN, F.: Principles and Practice of Urology. W. B. Saunders Company, Philadelphia, Pa., 1937. pp. 966-967.
7. ORR, L. M.; CARSON, R. B.; and NOVAK, W. F.: Statistical study of present-day methods used in treatment of tumors of bladder. *J. Urol.* **42**: 778-788, Nov. 1939.
8. ZUCKEKANDL, SCHEELE, JANSSEN, et al: Quoted by Barringer (2).
9. STRODE, J. E.: Uretero-intestinal transplantation. *Proc. Staff Meet. Clin. Honolulu* **12**: 177-179, July 1946.
10. COFFEY, R. C.: Quoted by Dobson, A. I., in *Urological Surgery*. C. V. Mosby Company, St. Louis, Mo., 1944. pp. 413-425.



CHORIORETINITIS JUXTAPAPILLARIS (JENSEN'S DISEASE)

HENRY G. BULLWINKEL
Captain (MC) U. S. N

Not long ago during a lecture to a group of recently graduated physicians a Kodachrome slide, from which figure 1 was made, was projected upon the screen. When asked to name the condition shown the immediate and apparently unanimous reply was: medullated nerve fibers. The following day the same slide was shown to a group of ophthalmologists. Each of these without exception, correctly identified the slide.

Because of this experience it seems worth while to present a brief review of the two conditions together with a fundus photograph of each.

Figure 2 was made from a Kodachrome of the fundus of the right eye of a Peruvian naval officer. It is that of medullated nerve fibers. The fundus of the left eye showed involvement of almost the same degree. These fundi were seen in the course of a refractive examination.

Mann (1) states that "after birth, disease and environmental changes are no longer classified among the causes of developmental anomalies, and such anomalies as arise during the early years are germinal or mutational—medullation of the nerve fibers is an example."

May (2) defines the medullated nerve fibers as those in which "some of the optic nerve fibers regain their medullary sheath at the disk, and continue in this condition for some distance, presenting whitish areas extending for a variable distance from the disk and terminating in brush-like extremities."

Fuch (3) lists medullated nerve fibers as "one of the early acquired anomalies of the retina." In explanation he states: "At birth the fibers of the optic nerve in its orbital section are nonmedullated. Within the first few months after



Figure 1.—Chorioretinitis juxtapapillaris (Jensen's disease).

birth they become medullated as far as the lamina cribrosa but within this or the disk or the retina regularly remain without medullary sheaths. In not a few cases, however, some of the intra-ocular fibers, too, become medullated. We then see with the ophthalmoscope a brilliant-white spot adjoining the edge of the disk and splitting at the periphery into white fibers so as to have a flame-like look. Such



Figure 2.—Medullated nerve fibers.

spots are formed most often at the upper and lower borders of the disk but may surround the disk completely, in which case the latter, by contrast, appears strikingly dark red. In rare cases white spots, formed of medullated fibers, lie within the disk itself or conversely far from it in the transparent retina. The retinal vessels are in places covered by the masses of white fibers. The vision may be normal or somewhat reduced, and the blind spot may be enlarged, though by no means always in proportion to the extent of the white patches seen in the fundus. It is thus evident that the medullary fibers are not absolutely opaque."

In 1908 Jensen first reported some half dozen cases of a type of choroiditis which had enough characteristics in common so that a separate entity could be recognized. To this he gave the term "chorioretinitis juxtapapillaris." In the course of time his name was applied to this condition—hence the term "Jensen's disease" became popular.

Berens (4) places this entity under chronic choroiditis. He states: "This form occurs in young persons 20 to 34 years of age as an exudation near the disk, oval in shape and about the same size as the disk. The cause is unknown. Vitreous opacities and sometimes keratitic precipitates are present. The inflammation slowly subsides leaving a patch of atrophy and a corresponding sector-shaped defect in the field of vision. Recurrences may take place."

Duke-Elder (5) states that the "etiology, course, prognosis, and treatment are the same as for a deep choroiditis elsewhere in the fundus, the only noteworthy point from the clinical aspect being the possibility of confusing the diagnosis in the active stage with optic neuritis."

Traquair (6) states that in mild cases the outer layer defect may be present alone; when the condition is more severe the inner layer defect is added. Traquair adds that the characteristic field defect may diminish or even disappear in time in some cases. Unless the macula is involved the prognosis for central vision is good.

De Schweinitz (7) seems to define the condition succinctly and accurately "as an inflammatory lesion with exudation which brings about an occlusion of the nutrient vascular twigs."

More recently Elwyn (8) who terms the condition retinochoroiditis observes that absorption of the lesion occurs from the periphery inward. It may disappear in a few months. There is left an area of atrophy—the choroid remaining partly exposed. The lesion may be bordered with pigment and there may be pigment scattered all over the healed lesion. The vitreous opacities disappear. Elwyn, in addition to citing the oft-mentioned etiological possibility of syphilis and tuberculosis, lays stress on septic foci—teeth, tonsils, and sinuses.

A case (see fig. 1) in which tobacco seems to have been, if not the basic cause, at least a contributing factor, is submitted.

CASE REPORT

O. H., age 38 years, a chief ship fitter, was admitted to the Eye Service of the U. S. Naval Hospital, Brooklyn, N. Y., 25 September 1947. He complained of increasingly blurred vision in the left eye for the previous 3 weeks.

Examination: Visual acuity OD 20/20; OS 16/20. A few vitreous opacities were seen in his left eye. Fundus examination: Adjoining the disk, nasally, there was an area of choroiditis about equal the size of the disk itself. The disk edges were hazy, especially on the nasal side. Careful and repeated fields showed a sector-shaped defect, temporally. Laboratory tests were all negative, including chest x-rays. The diagnosis in this case was confirmed independently by the consulting ophthalmologist.

In 1942 the patient had a similar attack and his record at that time showed a similar field defect. His previous medical history was negative except for a tonsillectomy after his first attack. He admitted being a very heavy smoker—40 cigarettes and several cigars comprised his daily consumption. At the time of this first attack in 1942 he abruptly stopped smoking. His vision slowly returned. For several years he smoked very little. However, for several weeks prior to this attack he had begun to increase his tobacco consumption. Upon admission 25 September 1947 tobacco was interdicted. He was under observation by doctors, nurses, and hospital corpsmen constantly and there can be no doubt but that he observed this restriction. Within a few days his vision improved subjectively. On 3 October his vision was OS 18/20 and on 10 October, OS 20/20 plus 2. His field defect was still present on discharge.

Ophthalmoscopically the disk edges appeared clear and the vitreous opacities could not be seen.

In conclusion it seems possible that in addition to the usually cited etiological agents in the causation of Jansen's disease, tobacco and the products of its combustion must be seriously considered.

REFERENCES

1. MANN, I.: *Developmental Abnormalities of the Eye*. The Macmillan Co., New York, N. Y., 1937. p. 45.
2. MAY, C. H.: *Manual of the Disease of the Eye for Students and Practitioners*. 17th edition, revised. Williams & Wilkins Co., Baltimore, Md., 1941. p. 40.

3. FUCHS, H. E.: *Text-Book of Ophthalmology*. 8th edition, revised. J. B. Lippincott Co., Philadelphia, Pa., 1924. p. 758.
4. BEERNS, C.: *The Eye and Its Diseases*. W. B. Saunders Co., Philadelphia, Pa., 1936. p. 687.
5. DUKE-ELDER, S. W.: *Text-Book of Ophthalmology; Volume III, Diseases of the Inner Eye*. C. V. Mosby Co., St. Louis, Mo., 1943. p. 2248.
6. TRAQUAIR, H. M.: *Introduction to Clinical Perimetry*. 4th edition, revised. Henry Kimpton (Hirschfeld Bros., Ltd.), London, 1942. p. 107.
7. DE SCHWEINITZ, G. E.: *Diseases of the Eye*. 10th edition. W. B. Saunders Co., Philadelphia, Pa., 1924. p. 391.
8. ELWYN, H.: *Diseases of the Retina*. The Blakiston Co., Philadelphia, Pa., 1946. pp. 389-394.



MENINGOCOCCAL MENINGOENCEPHALITIS

Report of a Case

JAMES C. HUMPHREY¹

Lieutenant (MC) U. S. N. R.

and

HARWELL G. DAVIS, JR.¹

Lieutenant (MC) U. S. N. R.

In spite of the fact that most standard texts of medicine relate sequelae of meningococcal meningitis suggesting encephalitic involvement, it was not until 1942 when Banks and McCartney (1) reported 10 cases of meningococcal encephalitis, all except 1 of which occurred in a widespread meningococcal epidemic during the winter of 1941, that attention was focused on this particular manifestation of meningococcal infection.

Later these authors (2) reported three additional cases calling attention to encephalitic involvement and a single case was reported in 1944 by Wortman and Hanger (3). These 14 cases comprise the total of the English references concerning this subject except for a report of the experimental production of meningococcal encephalitis in mice (4).

Because of the paucity of literature pertinent to this subject and several unusual features, it was considered worth while to report the following single case.

CASE REPORT

C. F., a 17-year-old white male, was admitted to the hospital on 11 February 1946. The day before admission to the hospital he was admitted to an outlying dispensary because of chills, fever, headache, and vomiting of a few hours duration. The physical examination at this time was negative except for a temperature elevation of 103.8° F. during the afternoon and so remained until 1300 the

¹ Inactive.

day of admission to the hospital when he developed a positive Kernig's sign and nuchal rigidity. At the dispensary he received 120,000 units of penicillin intramuscularly.

Upon admission the patient was irrational, did not respond to his name, and thrashed aimlessly about in bed. The temperature was 104.2° F. rectally, pulse 130, respirations 20, the blood pressure 150/80. The neck was rigid and Kernig's sign present. The deep reflexes were present and equal on both sides; the cremasteric and superficial abdominal reflexes could not be elicited. Ankle clonus was present bilaterally.

Lumbar puncture revealed the spinal fluid to be under increased pressure, cloudy and to contain 48,000 polymorphonuclear leukocytes per cubic centimeter. A Gram stain of the spinal fluid revealed gram-negative diplococci and a culture yielded organisms that were identified as *Neisseria intracellularis*. The total protein and chloride levels of the spinal fluid were 350 mg. and 627 mg. per 100 cc. respectively. Sugar was less than 10 mg. per 100 cc. The blood leukocyte count was 34,500 which were chiefly polymorphonuclear cells. The urine showed a one plus albumin.

Because of the severity of the infection it was decided to treat as follows: 20,000 units of penicillin in 10 cc. of distilled water was given intrathecally during the initial lumbar puncture and daily thereafter. 20,000 units of penicillin was given every 3 hours intramuscularly. Sodium sulfadiazine 4 grams was given intravenously in 1,000 cc. of 5 percent dextrose in distilled water and thereafter 2.5 grams was given every 8 hours. Penicillin up to 160,000 units daily was also given intravenously.

In spite of this treatment, the patient remained restless, irrational and difficult to manage. Two grams of sodium amytal were required over a period of 5 hours in order to accomplish the administration of intravenous fluids and medications. Approximately 6½ hours after admission he showed a blood pressure of 125/85 and pulse 120, at which time, his respiration ceased. He was given coramine, and caffeine sodium benzoate and placed in a Drinker respirator. He never regained consciousness.

At 0700 on 12 February, his temperature fell to 94° F. and never rose above 95° F. thereafter in spite of attempts to raise his environmental temperature. During this time the pulse varied between 54 and 80 and his condition remained unchanged and frequent aspirations of bronchial secretions were necessary until 14 February, 70 hours after admission. He developed some edema of the eyelids and sacrum. It was decided to decrease his fluid intake and give his sulfadiazine in 10 cc. of solution. There was a rise in blood urea nitrogen to 32 mg., creatinine to 1.9 mg. and nonprotein nitrogen to 60 mg. Urinary output fell to 900 cc. during this 24-hour period. Plasma proteins were 5.1 percent mg., and intravenous plasma was given. At 0400 on 15 February, he showed cardiac standstill and 1 cc. of epinephrine intraventricularly restored his pulse to 60. Throughout the remainder of life, his heart sounds were weak and irregular and only a few cc. of urine were obtained. All medication except penicillin, was discontinued. The heart action ceased approximately 100 hours after spontaneous respiration had stopped.

The spinal fluid showed a gradual decrease in cellular content until only 5,000 per cc. were present on the last puncture. The protein increased slightly, chlorides remained low and sugar became normal.

POSTMORTEM EXAMINATION

The trachea and larger bronchi were filled with a frothy, seropurulent material which exuded upon compression of the lungs. The dependent portion of both

lungs was of a mottled purple-maroon color and the smaller bronchi of this portion were filled with a mucopurulent material. Cultures of this material grew only saprophytic organisms in small quantity. The right lung weighed 680 gms., the left 450 gms.

Microscopic examination of the dependent portions showed edema fluid within the alveolae, edema and hyperamia of the alveolar walls, with infiltration with polymorphonuclear leukocytes and lymphocytes. The lining of the smallest bronchi was infiltrated with all types of white cells, and in some areas was beginning to slough. Sections of the nondependent portions were not unusual.

The heart showed a small subpericardial hemorrhage (caused by an intracardial injection of adrenalin prior to death) and cloudy swelling. Frozen sections stained with sudan III showed small, intracellular fat globules.

All parenchymatous organs showed marked cloudy swelling, but were otherwise not remarkable.

Grossly and microscopically the adrenals were not of abnormal appearance.

Upon opening the cranial vault, the dura mater was seen to bulge slightly. The dura showed no gross pathological changes. The leptomeninges were of grossly normal structure over the convex portion of the brain, showing only a small amount of almost clear serous fluid beneath them. This could be seen occupying only the larger fissures and sulci. At the base of the brain there were fibrous adhesions, particularly around the foramen magnum, extending from the blood vessels of the base of the brain to the periosteal dura of the base. Cultures, anaerobic on chocolate media and aerobically on blood agar plates, taken post mortem of the fluid beneath the meninges was sterile after 7 days.

The brain, upon removal was quite soft and did not retain its shape well; weighed 1,600 gms. The sulci were flattened and even the larger fissures were quite shallow. The brain was cut in the midline and the fourth ventricle and aqueduct were seen to be unobstructed and to contain about 3 cc. of seropurulent material. Cultures of this material showed no growth in 7 days. The cut surface showed a few small, punctuate hemorrhages irregularly distributed throughout the white matter. The organ was fixed in formalin for further study. Sections were made of the cerebral cortex and white matter from the frontal and parietal lobes, of the cerebellum, pons, corpus callosum and around the hypophyseal stalk. Sections were also made of areas containing the cerebral peduncles. All were stained with hematoxylin and eosin, several containing large amounts of white matter were stained with a modified Ranson silver stain and some from the cerebral hemispheres were stained with a modified Papanheim's methyl green for bacteria.

There was no regularity of distribution of the lesions except that those attributable to an encephalitic process were almost entirely limited to the white matter and none were seen in the cerebellum.

Those lesions which were hemorrhagic in nature were seen only in the white matter and consisted of areas of fresh to moderately old red cells in somewhat degenerated white matter. No older hemorrhages containing completely crenated red cells were seen. There was no regularity of distribution of these lesions.

The other major lesion consisted of small to medium-sized collections of lymphocytes with a few monocytes and a lesser number of cells resembling glial cells. There was marked necrosis of the brain substance throughout the organ, but it was apparently more marked in these areas. No polymorphonuclear leukocytes were seen. Scant perivascular small round cell infiltration was

present on rare occasion. No polymorphonuclear infiltration was noted in these collections.

The gray matter showed a few small collections of lymphocytes scattered irregularly throughout and occasional regular, layered infiltration of lymphocytes submeningeally, both more marked toward the base of the parietal lobes. The nuclei showed all stages of dissolution throughout, varying from single chromatolysis in the cells of the basal ganglia to complete dissolution of some in the cerebral cortex. No bacteria were to be found, either in the sections of the brain or in those of the meninges.

SUMMARY

A case of meningococcic meningoencephalitis and postmortem examination is presented. It was characterized by fulminating development of delirium, quickly followed by deep coma, respiratory failure and poikilothermia. Cardiac action continued for about 100 hours following cessation of voluntary respiratory activity. Postmortem findings revealed widespread encephalitis, involving chiefly the white matter, without demyelination and only slight evidence of the apparently subsiding meningitis.

REFERENCES

1. BANKS, H. S., and MCCARTNEY, J. E.: Meningococcal encephalitis. *Lancet* 1: 219-223, Feb. 21, 1942.
2. BANKS, H. S., and MCCARTNEY, J. E.: *Lancet* 1: 771-774, June 19, 1942.
3. WARTMAN, W. B., and HANGER, I. C.: Acute meningococcal encephalomyelitis. *Am. J. M. Sc.* 208: 234-240, Aug. 1944.
4. ANDREWES, C. H., and LUSH, D.: Experimental meningococcal meningo-encephalitis in mice. *J. Path. & Bact.* 52: 85-90, Jan. 1941.

ACKNOWLEDGMENT.—The authors wish to express their appreciation to Capt. C. W. Brunson (MC) USN for his help in the preparation of this report.



PSEUDOHEMOPHILIA

Report of a Case Simulating Acute Appendicitis

GEORGE L. CALVY

Commander (MC) U. S. N.

The differential diagnostic points at issue in evaluating the acute abdomen are legion. At times, as in the following experience, the clinician may receive aid from unexpected sources, a matter of fortuity.

One evening afloat, a young seaman appeared at sick call and announced that he had acute appendicitis, presenting solid objective evidence in support of his contention.

The signs, symptoms, and general circumstances suggested an appendical syndrome. The past medical history contained similar episodes of abdominal pain, the most recent 6 months before. At that time, the subject had been hospitalized and prepared for surgery; with subsequent improvement by morning, family objection postponed intervention. The family doctor issued the stern injunction that another attack might not end so favorably.

Physical examination was accomplished and further support for the same diagnosis was found. Familial history was noninformative save for mention of the sudden death of a sister, aged 22, from a "blood clot on the brain."

The usual laboratory procedures, a complete blood count and urinalysis, were done; bleeding and clotting times were ordered, practically as an afterthought. The writer outlined preparations for the operation pending receipt of laboratory data.

Some minutes later, the laboratory man returned, excitedly waved a crimson stained towel and announced, "I stuck his ear and he bled this full." Forthwith, the tempo and direction of the collective effort suffered modification.

CASE REPORT

CLINICAL DATA

H. N., S 1/c, age 18 years, experienced cramping, para-umbilical pain on arising; nauseated, he took no food. By noon, pain had shifted to the right lower quadrant and malaise was prominent. Questioning elicited elements of past medical and familial histories as above. Allergic, rheumatic, and hemorrhagic involvement was denied. There was no knowledge of bleeding tendencies in his family or forebears.

Physical examination revealed an immature, lightly-strung, asthenic blonde male; facies appeared flushed and the skin was sun-tanned. Temperature, pulse, and respirations were within normal limits. Examination of the chest and the cardiovascular apparatus was negative. The upper respiratory tract was not remarkable.

Abdominal examination disclosed point tenderness in the right lower quadrant. A spleen was palpable. Examination per rectum was noncontributory.

Neither petechiae nor ecchymoses were observed.

LABORATORY DATA

1. Red blood count, 3,600,000.
2. Hemoglobin, 12.6 grams (76%).
3. White blood cells, 9,600.
4. Differential:
 - Neutrophils, 40.
 - Lymphocytes, 52.
 - Eosinophils, 8.
5. *Bleeding time*, 7¼ minutes. (Duke).
6. *Coagulation time*, 6 minutes. (Burker).
7. Platelet count, 240,000.
8. *Nonretractile clot*.

9. Urinalysis revealed RBC's microscopically.
10. Capillary resistance (tourniquet) test negative.
(Later became positive).
11. Examination of stool was noncontributory.

It was apparent that an uncommon hemorrhagic diathesis was at hand. Supportive measures, including whole blood transfusions, were employed and the patient improved progressively, both subjectively and objectively. He remained on the sick list aboard ship for 12 days and was then transferred to an island base hospital. During this period, the following persisted: (a) Prolongation of bleeding time; (b) absent to poor clot retractility; (c) intermittently positive capillary fragility; (d) normal platelet counts; and (e) absence of further eosinophilia.

THE ENTITY (VON WILLEBRAND TYPE)

The occurrence of hemophilia among male members of the royal families, Bourbon-Hapsburg and Romanoff, and its transmission through females to males of subsequent generations is well recorded in popular literature.

A hereditary hemorrhagic disease transmitted by and appearing in both males and females, characterized by a prolonged bleeding time, and with no demonstrable abnormality of the blood nor of the coagulation mechanism, has been described in detail by von Willebrand (1). A Swedish family with bleeding tendencies was studied. The findings were a prolonged bleeding time, normal or increased platelets, and a normal coagulation time. Of the 58 members of the family, 23 were bleeders. Other independent reports have appeared and the principals affected have been strikingly Nordic types, though two cases have been observed in Negroes.

Heredity.—The family studied by von Willebrand lived on an island in the Baltic, was isolated from other communities, and tended to intermarriage, thus undoubtedly intensifying the manifestations of the disease.

Geneticists conclude that the disease is inherited through a dominant sex-linked character residing in the X chromosome. The male can therefore only show the disease in a simple form since he has only one X chromosome. The female can manifest it in two types depending on whether she is homozygous or heterozygous for the X chromosome (3). In this family of 32 females, 16 were bleeders; of the 26 males, only 7 exhibited the hemorrhagic disease. The 6 cases of fatal hemorrhage all occurred in women.

Hemorrhagic tendency.—The tendency may be manifested in easy bleeding and bruising, yet in Minot's series neither purpura nor petechiae were observed; this has been a notable observation in subsequent reports (4). Generally, prolonged bleeding after minor surgical procedures (tonsillectomy and tooth extraction) is encountered in

these individuals. Hemorrhage may also issue from the gingivae, gastro-intestinal tract, uterus, and other organs.

Blood findings.—The blood picture may be essentially negative save for a characteristic prolongation of the bleeding time, this latter varying within wide limits. In mild cases, the bleeding time often returns to normal. Clot retraction may or may not be abnormal (delayed or absent). Capillary resistance (tourniquet) test may or may not be positive and is frequently intermittently positive. Platelet counts are normal or increased.

The defect.—At one time, the bleeding tendency was attributed to a platelet defect; satisfactory evidence for this is lacking. In microscopic studies of nail bed capillaries of these individuals, Macfarlane demonstrated the fault to be in the vascular system, possibly due to an intrinsic factor. *The vessels fail to undergo contracture after injury and permit continuous oozing (5).*

DIAGNOSIS

Occurrence of the bleeding tendency in both males and females and its transmission to both sexes in subsequent generations suggests pseudohemophilia. Absence of familial history of bleeding, however, excludes neither this disease nor hemophilia (2). The bleeding time is prolonged. (Duke, “* * * beyond 6 minutes is definitely pathological.”) This is by far the most important finding, and if negative, the test should be repeated, for the bleeding tendency occurs intermittently. The normal platelet count differentiates from thrombocytopenic purpura. Failure of response to vitamin C excludes scurvy from consideration. No abnormality in the coagulation mechanism is demonstrable.

TREATMENT

There is no specific treatment, rather should one seek the answer through control measures in a genetic sense. Intermarriage of these families should be emphatically discouraged. Replacement and supportive measures may be employed as indicated. Splenectomy has been unsuccessful. Superficial and accessible bleeding can usually be controlled by pressure and local application of thrombin-fibrin foam, or thrombin-soaked gauze.

SUMMARY

A clinical history has been presented that meets criteria for establishing a diagnosis of pseudohemophilia. It was interesting to uncover data on the circumstances of the sister's death and learn from the autopsy abstract that her death was caused by a cerebral hemorrhage from “a rather small vessel.” She had been in apparent good

health. One evening, while running across a street to gain shelter from a rainstorm, she collapsed.

The hemorrhagic diatheses have come into increasing prominence in the past few years and pseudohemophilia of the "von Willebrand type" commands interest because of its primary vascular abnormality. It has been suggested that it is at least as common as hemophilia and more common than has been appreciated (6).

Evidence as to selection of these cases for surgery is incomplete; since there is no satisfactory way of distinguishing the mild from the severe bleeders, pseudohemophilia is a definite contraindication to elective surgery.

The occasional surgeon should at least be cognizant of these potential hazards in undertaking surgical procedures. The report of Cronkite and Lozner (7) cites the case of a young soldier who bled protractedly after a simple hemorrhoidectomy.

The mechanism of development of abdominal pain in the current case is conjectural—hemorrhage into the mesenteric root!

REFERENCES

1. von WILLEBRAND, E. A.: Über hereditäre Pseudohämophilie. *Acta med. Scandinav.* 76: 521-550, 1931.
2. ESTERN, S.; MEDAL, L.; and DAMESHEK, W.: Pseudohemophilia. *Blood* 1: 504-533, Nov. 1946.
3. QUICK, A. J.: *The Hemorrhagic Diseases and the Physiology of Hemostasis.* Charles C. Thomas, Springfield, Ill., 1942.
4. MINOT, G. R.: Familial hemorrhagic condition associated with prolongation of bleeding time. *Am. J. Sc.* 175: 301-306, Mar. 1928.
5. MACFARLANE, R. G.: Critical review: Mechanism of haemostasis. *Quart. J. Med.* 10: 1-29, Jan. 1941.
6. CLOUGH, P. W.: Editorial: Pseudohemophilia. *Ann. Int. Med.* 26: 459-464, 1947.
7. CRONKITE, E. P., and LOZNER, E. L.: Hereditary hemorrhagic thrombasthenia with severe post-hemorrhoidectomy hemorrhage. *U. S. Nav. M. Bull.* 42: 161-164, Jan. 1944.



ENCEPHALITIS DUE TO ANTIRABIES VACCINE

Report of a Case

ALVIN M. SIEGLER

Lieutenant, junior grade (MC) U. S. N. R.

Antirabies vaccine infrequently causes neurological reactions of various types; these are seen less frequently in children than in adults.

Encephalitis is one of the more unusual manifestations of this complication.

A case of an encephalitic reaction due to antirabies vaccine in a child is presented.

CASE REPORT

On 27 July 1946 an 8-year-old Negro boy was bitten on the left forearm by a stray dog and thereupon was immediately taken to a hospital, where the wound was cauterized. The following day, the patient was taken to the New York City Board of Health Clinic, where a 14-day antirabies treatment was instituted with phenolized (Semple) vaccine. He was asymptomatic during the entire course of therapy except for one febrile episode (100° F.) lasting 1 day.

The onset of the present illness began 2 days after the cessation of treatment. He was admitted to the hospital on 14 August 1946 with lethargy for 3 days. On 19 August 1946 the child had complained of headache, double vision in the right eye, and he staggered about the house. The following day his mother noticed that he drooled, could masticate only with much difficulty, his tongue deviated to the right, and he complained of generalized weakness. His speech was slurred and unintelligible. He had a headache, was very drowsy, and had a temperature of 101.6° F. There were no chills, vomiting, or convulsions, but he had fine tremors in all the extremities when sitting or standing. He had been slightly constipated 3 days prior to admission; there was no incontinence. This patient had one previous admission to the hospital for a head injury on 25 October 1945 but was discharged the next day after a spinal tap and x-ray of the skull were both normal.

Physical examination upon admission to the hospital revealed a lethargic Negro child of an asthenic habitus, well nourished, and appearing acutely ill but in no cardiac or respiratory distress. He was aroused with difficulty but when awake was very cooperative; all movements were slow and laborious. His temperature was 101.2° F.; pulse 80 beats per minute, strong and regular; blood pressure of 110 mm. of mercury systolic and 75 mm. diastolic. The skin was warm and moist; no rashes were visible. There were a few pea-sized cervical lymph glands palpable, bilaterally. The pupils were round, regular, and equal. They reacted briskly to light but did not converge on accommodation. The patient moved them up and down slowly but not from side to side. Fundus-copic examination showed physiological cupping but no choking or papilledema. The tongue protruded toward the right and there was drooling noted, but associated pharyngeal and palatal movements were normal. Ears, nose, and throat were normal. The lungs were clear to percussion and auscultation. There were less spontaneous movements of the right extremities than the left and less power in the hand grip on the right. No gross abnormal movements were observed. The abdominals and cremasterics were absent and the deep tendon reflexes were all diminished, but the right triceps was more active than the left and the right biceps more active than on the left. There was a definite Babinski on the right and an equivocal one on the left. Sensation was grossly intact and there were no cerebellar signs.

Urine was negative and the blood showed a hemoglobin value of 11 grams with 4.1 million red blood cells. The count of white cells was 10,500 per cu. mm. with 54 percent polymorphonuclear leukocytes, 42 percent lymphocytes, and 4 percent monocytes. A spinal tap revealed a crystal-clear fluid with 90 percent lymphocytes and 10 percent polymorphonuclear leukocytes. The chemical analysis of the spinal

fluid showed 68 mg. percent protein, 51 mg. percent sugar, and 690 mg. percent chlorides. Bacteriological studies on the spinal fluid revealed no growth and no organisms on smear. A blood culture taken on admission grew out *Bacillus subtilis*—most likely a contaminant. Nose and throat culture revealed no bacterial pathogens other than *Streptococcus viridans*. Blood Wasserman was negative and a Schick and Mantoux 1-1,000 produced no reactions. X-ray examinations of the chest and skull showed no abnormalities. Studies at Rockefeller Institute to rule out any other known types of virus encephalitis were made on the spinal fluid and blood and were reported as negative.

Symptomatic therapy was instituted. The temperature returned to normal on the last day and remained as such except for one episode of 100° F. On the second hospital day, a definite left central facial paralysis was noted and a paresis of the left upper eyelid. A spinal tap was repeated on the sixth day and the Pandy showed only a faint cloudiness and 10 cells per cm.—all lymphocytes. By the seventh day the extra-ocular muscles were normal, the facial paralysis subsided, and he had regained almost all of his muscle power. However, there still seemed to be a lack of playfulness and spontaneity in his actions. Vitamin B₁, 100 mg. per day, was administered on the eighth day. The patient became completely symptom-free on the twelfth day and was discharged to the out-patient department in excellent condition. In essence, his progress in the hospital was marked by rapid clinical improvement and the disappearance of all abnormal neurological manifestations.

COMMENT

In reviewing the literature, one notes the infrequency of neurological reactions due to antirabies vaccine per se, and especially of this type of manifestation in childhood. Remlinger (1) reported 529 cases in 1,164,264 patients treated all over the world. Nearly all reactions were in adults and two-thirds took place during treatment and the remainder shortly after its completion. Holt and McIntosh (2) state that reactions occur once in every 2,500 treatments when vaccines containing virulent virus are used, but only once in 9,000 treatments when vaccine in which the virus has been destroyed are used. Mason and Dille (3) reported 1 case in a child of 9 years who presented neuritic symptoms of several peripheral nerves. A striking fact is that children account for a small number of accidents although 50 percent of all treatments are given to the younger groups. Marinescu et al. (4) presented 3 cases of paralytic accidents in adults within polyradiculoneuritic manifestations, a complication which has rarely been observed. Mirolubova (5) states that in 10 years (from 1920 to 1930) there were only 10 complications observed in the 7,500 persons subjected to antirabies vaccination in his clinic. The youngest of the 10 patients in whom complications developed was 17 years of age, although more than 50 percent of his patients subjected to treatment were less than 15 years of age. Webster (6) and Casals (7) summarized reactions to rabies vaccine. In slightly over 1,000,000 treatments, major paralytic accidents occurred in 181 subjects (1 in 5,861) and 48 were fatal (1 in 22,100). Neurological complications were more frequent following

the use of attenuated virus vaccines than with the vaccines prepared from the killed virus (1 in 3,398) as against (1 in 8,887). This supports the theory that such reactions are due to traces of viable virus and infective mixed virus.

The etiology of these reactions is still very controversial. Bassoe and Grinker (8), in reviewing the pathology of fatal paralytic accidents from the use of antirabies vaccine, note a similarity with other virus encephalitis. They conclude therefore, that the theory that the vaccine encephalomyelitis is due to toxic products within the vaccine, perhaps from the nerve tissue of the rabbit, is not probable. It is remarkable to note almost the exact identity of the lesions found in cowpox and rabies vaccine encephalomyelitis. However, the similarity in the pathological reactions does not mean an identity of the causative agents since the pathological changes of the central nervous system are rather stereotyped. In summarizing these observations one may advance the question as to whether there exists a specific toxin for rabies. Some authors are of the opinion that it is capable of producing paralysis admitting, however, that the existence of this toxin has never been proved. On the other hand, a virus may play an important part in producing the phenomena which are observed in the complications following antirabies injections but the human system checks the progress of their virulence. While great importance may be attached to a probable virus, one must not lose sight of the experience that shows that careless injections for immunization often result in the complications described. It is urged not to make several injections in one day or to give an indiscriminate intense dose at one time. Another oft-discussed theory is that in the body of the injured patient there may exist a latent neurotropic virus which may be activated by the vaccination and may lead therefore to a picture of meningoencephalitis. Kelser (9) suggests that the occurrence of complications with the use of phenolized (Semple) vaccine may be explained by the ability of phenol to coagulate proteins so that occasional units of viable virus are left with coagulated particles.

The symptomatology of these paralyses is customarily divided into three types. They may all have such premonitory signs as vomiting, lumbar pains, chills, fever, pain, numbness or tingling in a muscle or muscle group preceding paralysis. One type resembles a Landry's paralysis, presenting a condition which one would expect with ascending ablation of cord function. The symptoms may go on to bulbar paralysis and subsequent impairment in breathing, deglutition, and speech. The mortality of this type is stated to be about 30 percent while those who recover are well in a few days to several weeks with varying residue of weakness. Another type resembles a dorsolumbar myelitis which is manifested by gradual weakening of lower limb

muscles to complete paralysis with absent reflexes. Recovery is complete in a few weeks. Mortality in this group is 6 percent. The third type is that presenting the usual symptoms of a neuritis of one or more peripheral nerves—facial being most commonly involved.

Horack (10) who claims that reactions are of an allergic nature cites 16 cases of paralysis in which 87.5 percent had an incidence of allergic disease as compared to 33 percent in a control group in which no neuromuscular reactions occurred. Our patient had no history of any allergy. The fact is emphasized by some that complications develop usually in individuals presenting some abnormality; in 3 of 7 cases, a history of alcoholism was present; 3 others were senile and 1 in a state of general debility. The Pasteur Institute warns that over-exertion during treatment seems to be a precipitating factor in the development of these paralyses. It is interesting to note that there were 4 other reactions reported by the New York City Board of Health with the use of this supply of vaccine. All, however, were of a minor nature and only 1 occurred in a child who had few neurological manifestations.

There is difficulty at times in differentiating a complication of the vaccine treatment from rabies per se. The time of onset has been from 11 to 30 days after the bite for which the treatment was given, showing that the period of incubation is shorter than rabies itself which is usually from 40 to 60 days. One author (4) reported a case of rabic encephalomyelitis during vaccine therapy which was suspected of being due to treatment and histologically demonstrated the existence of rabies. Even in such cases the possibility of an attenuated rabic virus must be kept in mind. However, as the same vaccine was used on patients without any complications, a faulty technique in preparation of the vaccine could not have been responsible.

There is apparently no treatment for this complication. Thomas (11) rationalizes that, since the cause of post-vaccine encephalitis has not been proved, a means for its prevention cannot be found. However, he suggests that all patients should be tested for sensitivity and desensitized before initiating treatment. He cites a case of Landry's paralysis in which a modified Kenny treatment was applied and a regime of vitamin B₁ was administered with subsequent recovery. The author admits to the questionable value of such therapy and the possibility of the patient having recovered regardless of treatment.

SUMMARY

1. Vaccine encephalitis due to antirabies vaccine is rare in children.
2. The etiological agent is undetermined and there is no specific treatment.

REFERENCES

1. REMLINGER, P.: Les paralysies du traitement antirabique. *Ann d l'Inst. Pasteur* (suppl., Conférence Internationale de la Rage) pp. 71-132, 1928.
2. HOLT, L. E., and HOWLAND, J.: *Diseases of Infancy and Childhood*. 11th edition, revised by L. E. Holt, Jr., and R. McIntosh. D. Appleton-Century Co., Inc., New York, N. Y., 1940.
3. MASON, L. W., and DILLE, R. S.: Paralytic accidents due to rabies vaccine. *Illinois M. J.* 79: 414-418, May 1941.
4. MARINESCU, G., and DRAGANESCO, S.: Contribution à l'étude des accidents post-vaccino-rabiques (à l'occasion d'un cas avec examen anatomo-clinique). *Ann. Inst. Pasteur* 60: 477-498, May 1938.
5. MIROLIUBOVA, E. I.: Complications in antirabic inoculations. *Gig. i. epidemiol.* 9: 45-48, Aug.-Sept. 1930.
6. WEBSTER, L. T.: Antirabic vaccination—present status. *Am. J. Pub. Health* 31: 57-59, Jan. 1941.
7. CASALS, J.: Current view of rabies problem. *Ann. Inst. Med.* 23: 74-78, July 1945.
8. BASOE, P., and GRINKER, R. R.: Human rabies and rabies vaccine encephalomyelitis; clinicopathologic study. *Arch. Neurol. & Psychiat.* 23: 1138-1160, June 1930.
9. KELSEY, R. A.: Rabies immunization. *Mil. Surgeon* 69: 34-41, July 1931.
10. HORACK, H. M.: Allergy as factor in development of reactions to anti-rabic treatment. *Am. J. M. Sc.* 197: 672-682, May 1939.
11. THOMAS, C. R.: Complications following use of antirabies vaccine with suggestions as to treatment. *South. M. J.* 37: 539-543, Oct. 1944.



BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

TEXTBOOK OF THE EAR, NOSE, AND THROAT, by Francis L. Lederer, B. Sc., M. D., F. A. C. S., *Professor and Head of Department of Otolaryngology, University of Illinois College of Medicine, Chicago; Chief of the Otolaryngological Service, Research and Educational Hospital; Director of Education and Chief of the Ear, Nose and Throat Services, Illinois Eye and Ear Infirmary; Captain, Medical Corps, United States Naval Reserve and Abraham R. Hollender, M. Sc., M. D., F. A. C. S., Professor of Otolaryngology, Emeritus, University of Illinois College of Medicine, Chicago; Attending Otolaryngologist, St. Francis Hospital, Miami Beach, Florida.* 2d edition. 596 pages; 182 illustrations. F. A. Davis Company, publishers, Philadelphia, Pa., 1947. Price \$7.

The first edition having gone through two printings, this edition is revised and reprinted to complete changes due to war and postwar developments.

The rapid progress in chemotherapy, the antibiotics, and the newer knowledge of the allergies have made the revision of this standard textbook necessary, and it is modern enough to include the newer medications, even to the newer antihistamines of 1946 and 1947.

This volume, sufficiently balanced to the trends of the elimination of radical surgery by chemotherapy and the antibiotics is even more complete in its outlines than the prewar volume. A fine textbook for the student and the early special student of otolaryngology.

Necessarily limited by the present expanded field of its specialty, it clearly outlines the fundamentals, clearly defined, of present-day clinical knowledge.

The thought is created in several parts that a more expanded text might be desired, but the subject matter covered gives the necessary outlines that can be easily followed in more exact detail in more highly specialized texts.

DISEASES OF THE NOSE AND THROAT AND EAR. by William Lincoln Ballenger, M. D., F. A. C. S. *Late professor School of Medicine University of Illinois, Chicago*, and Howard Charles Ballenger M. D., F. A. C. S. *Associate Professor and Acting Chairman Department of Otolaryngology, Northwestern University School of Medicine, Chicago*; assisted by John Jacob Ballenger, B. S., M. D., *Research Fellow in Otolaryngology, Northwestern University School of Medicine, Chicago*. 9th edition, revised. 993 pages; 597 illustrations and 16 color plates. Lea & Febiger, Philadelphia, Pa., publishers, 1947. \$12.50.

This is a completely modern edition and sufficiently changed to warrant renewal of currently stocked editions. A necessary part of the up-to-date library of a otolaryngology department.

This is the standard book of treatment of the diseases of the nose, throat, and ear, and as current as the year issued. It covers in complete detail the standard outlines of treatment, both medical and surgical, of practically all acknowledged clinical entities, including the necessary anatomy and physiology, but with closely complete editing.

A new and timely chapter on headaches and neuralgias has been added, not sufficient to extend over into the field of neurologist, but sufficient to use unless special studies beyond those of guidance are desired. The chapter on rhinoplastic reconstruction is very adequate for this type of text and sufficiently illustrated to be valuable for ready reference.

This volume has as collaborators Drs. J. D. Kelly, Alfred Lewy, Gabriel Tucker, and C. L. Jackson.

Easy to read, easily accessible for reference and particularly valuable in its general field by the addition of a final section on laryngoscopy, bronchoscopy, esophagoscopy, and gastroscopy, while more in the manual, outline form, completes the necessary clinical coverage of a book of this kind.

SCIENCE SINCE 1500—a Short History of Mathematics, Physics, Chemistry, and Biology, by H. T. Pledge, B.A. 357 pages; illustrated. Philosophical Library, New York, N. Y., 1947. Price \$5.

First printed in 1940 this valuable and concise manual has been reprinted in 1940 and 1947. This is evidence of its popularity and indeed it furnishes a bird's-eye view of the sciences since the Renaissance. There are a number of large histories of science and of each of the sciences but few that give a brief but correct account of the whole field. One interesting feature among many are the studies of the grouping of the birthplaces of great scientists and of speculation as to the reasons for these "clusters" of scientists in geographic zones.

ENDOCRINOLOGY OF NEOPLASTIC DISEASES, a monograph of a symposium by eighteen authors; edited by Gray H. Twombly, M.D., and George T. Pack, M.D. 392 pages; illustrated. Oxford University Press, New York, N. Y., publisher, 1947. Price \$11.

With the increased impetus given to the study and therapy of neoplastic diseases, this monograph affords an authoritative reference to the endocrinological aspects of oncology. The monography is based on a series of articles dealing with the endocrinology of neoplastic diseases which appeared as a symposium in surgery, July and August 1944, but which has been revised and brought up to date.

The book is a symposium by 18 well-known and recognized authors in the field. They have presented an exceedingly lucid, yet comprehensive, review of endocrinology as it pertains to neoplastic diseases. One of the great assets of the book is that it summarizes the substance of a controversial literature and treats the subject matter from both the experimental and clinical viewpoints in a sequential manner. The endocrine relationships of pituitary, ovarian, uterine, breast, prostate, testicular, adrenal, thyroid, parathyroid, pancreatic, and pineal tumors comprise the majority of topics discussed.

The bibliography, though not exhaustive, is pertinent and well chosen. The illustrations are likewise germane to the subject matter.

The book can be highly recommended to any medical officer, and it is of inestimable value to those who diagnose, study, and treat neoplastic diseases.

ATLAS OF BACTERIOLOGY, by R. Cranston Low, M.D., F.R.C.P.E., F.R.S.E., *Bacteriology Department, University of Edinburgh; Consulting Physician to the Skin Department, Royal Infirmary, Edinburgh; Formerly Lecturer of Diseases of the Skin, University of Edinburgh* and T. C. Dodds, F.I.M.L.T., F.I.B.P., F.R.P.S., *Laboratory Supervisor to the Department of Pathology, University of Edinburgh; Lecturer to the Society of Radiographers (Fellowship Course) Scottish Branch*. 170 pages; 168 illustrations of which 167 are in color. The Williams & Wilkins Company, Baltimore, Md., publishers, 1947. Price \$8.50.

This atlas is a much needed adjunct to any of the standard textbooks on bacteriology, which in the majority of instances are inadequately illustrated. It would be an excellent reference for any student of bacteriology as well as a handy reference in any bacteriology laboratory.

The illustrations are natural color photographs and microphotographs and are beautifully reproduced. Each organism is illustrated in a systematic manner; first, stained smears of fresh material, followed by stained smears from cultures, then histological sections demonstrating the organisms in vivo and finally the appearance of the colonies in cultures.

In addition to the pathogenic bacteria, other pathogenic organisms including some of the rickettsia, viruses, fungi, and protozoa are beautifully illustrated.

DISABILITY EVALUATION, Principles of Treatment of Compensable Injuries, by Earl D. McBride, B.S., M.D., F.A.C.S., *Assistant Professor of Orthopedic Surgery, University of Oklahoma, School of Medicine*. 4th edition. 667 pages; 400 illustrations. J. B. Lippincott Co., Philadelphia, Pa., 1948. Price \$12.

This is an attempt to measure injuries by setting up arbitrary scales showing percentage of loss of functions. The schedules recorded by the International Association of Industrial Accident Boards and Commissions are used in the main as the measuring rods although others are noted and described. The illustrations giving graphic pictures of how a disability actually disables are of particular interest. The description of the routine examination of the back is most valuable. With the increasing importance of women in industry some space devoted to that subject would be desirable in a future edition.

THE PRACTICE OF MENTAL NURSING, by May Houliston, R. G. N., R. M. N., R. F. N., *Sister Tutor's Certificate, Royal College of Nursing, Diploma in Nursing, London University; Senior Sister Tutor, Crichton Royal Mental Hospital, Dumfries*. 164 pages; no illustrations. The Williams & Wilkins Company, Baltimore, Md., publishers, 1947. Price \$2.75.

As this book states in the Preface, it is written primarily for the junior student nurses in a mental hospital. It gives them the basic information concerning the nursing care of mental patients with the idea of a more detailed study as the student advances.

It is not considered by the reviewer the type of book to be of value to the U. S. Navy since the courses given for the hospital corpsmen are short and condensed and must include a greater field of mental nursing.

COLOR ATLAS OF HEMATOLOGY, by Roy R. Kracke, M.D., *Dean and Professor of Clinical Medicine, Medical College of Alabama, Birmingham, Alabama*. 204 pages; 32 plates in full color and 3 plates in black and white. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$5.

This small atlas of hematology contains some fairly concise and useful information on definitions of hematologic terms and procedures. The descriptions of blood dyscrasias are short and worthwhile. However, the color plates for which it was published are definitely inferior. In general, the color reproduction does not do justice to the artist's drawings.

UTERO-TUBAL INSUFFLATION, by I. C. Rubin, M. D., F. A. C. S., *Clinical Professor of Gynecology, College of Physicians and Surgeons, Columbia University; Consulting Gynecologist, Mount Sinai Hospital; Visiting Gynecologist, Montefiore Hospital; Consulting Gynecologist, Beth Israel Hospital, New York*. First edition. 453 pages; 159 illustrations, including four in color. The C. V. Mosby Company, St. Louis, Mo., publishers, 1947. Price \$10.

This is a compilation of data, illustrations from personal material, results of experiments and conclusions gathered over a period of more than 25 years by the author.

The author has divided the book into 5 parts. The first 4 parts make up the body of the book and are divided into some 13 chapters. These 4 parts cover anatomy, pathology, and physiology of the fallopian tubes; technique of tubal insufflation diagnosis; therapy; and comparison of kymographic tubal insufflation and intrauterine injection of lipiodol and other iodized oils. Part 5 is devoted to the appendix, which is a very valuable part of this book. The references are very complete and fill some 24 pages.

The illustrations are drawn from material in the author's own experience for the most part. These aid greatly in following the text.

The author's experience has extended over a period of many years and is extremely wide and varied. For this reason there is a great tendency to verbosity regarding his experiences and much is devoted to proving facts which are well enough accepted today without such proof. The author delves much into comparative physiology, which adds much to the book for research men but results in much wasted reading for the clinician who wants a ready and concise reference. It is felt that the author could have combined many chapters and avoided much repetition of similar facts.

The author has done a fine job on the summary at the end of each chapter, and for one with limited time it is recommended that one read the summary first and see if the answer is not there.

THE PREMATURE BABY, by V. Mary Crosse, M. D. (London), D. P. H., M. M. S. A., D. R. C. O. G., *Chief Obstetric Officer in charge of City of Birmingham Maternity Homes and Premature Baby Unit; Deputy Senior Assistant Medical Officer of Health (for Maternity and Child Welfare), City of Birmingham; Examiner for Central Midwives Board.* Foreword by Leonard G. Parsons, M. D., F. R. C. P., F. R. C. O. G., *Professor of Children's Diseases, University of Birmingham.* 156 pages; 14 illustrations. The Blakiston Company, Philadelphia, Pa., publishers, 1946. Price \$3.

This book is an excellent one on the care of the premature baby. Comparison of the premature infant with the normal infant and its care during the course of labor and following birth has been discussed very fully and concisely.

The part of the book discussing symptoms should prove invaluable for one nursing the premature infant, as it is through this that many severe complications may be avoided. Statistics of the City Maternity Home (Sorrento) Birmingham have been presented in the appendix. There are a few illustrations.

References at the end of each chapter include writers of several countries. This book should be a great help to those given the responsibility of nursing the premature infant.

NURSING, by Lulu K. Wolf, R. N., B. S., M. P. H., *Professor of Nursing, Vanderbilt University School of Nursing*. 534 pages; numerous illustrations. D. Appleton-Century Co., Inc., New York, N. Y., publisher, 1947. Price \$3.50.

Reading this book was a pleasure. The first chapters deal with the history, undertakings, accomplishments and aspirations of nursing. Present-day trends in the nursing field with accent on the importance of higher education for the twentieth century nurse to keep up with demands of a swiftly advancing medical profession and an ever changing society has been stressed. Why and how changes are being brought about to carry out this educational program has been discussed here.

The care of the patient is presented as the main objective of nursing, however, the nurse as one of the main contributors to the community and national health programs is well defined. The chapters devoted to nursing procedures, made interesting by completeness and simplicity, make this a good text. Special treatments are presented to their best advantage. Illustrations used are very descriptive and chapter summaries are especially beneficial.



PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



MEDICAL SURVEYS FOR PULMONARY TUBERCULOSIS

SIDNEY A. BRITTEN

Commander (MC) USN

and

CARL J. HEISSER

Statistician, Medical Statistics Division

Bureau of Medicine and Surgery, U. S. Navy Department

It is the purpose of this study to (a) review reports of medical survey for patients with pulmonary tuberculosis and (b) evaluate the program of mass photofluorography on the basis of these pulmonary tuberculosis surveys.

This subject has been discussed previously (1), but it seems worth while to again call attention to these data and to note any change that may have occurred as the result of the program of mass photofluorography in the Navy and Marine Corps. At the time of the initial presentation the program of mass photofluorography had advanced only to the stage of partial completion and additional photofluorographic units were being situated at strategic locations in the continental and noncontinental area. This was accomplished in late 1945 at which time the goal of over 2,000,000 x-rays a year was reached (2). The data in this report thus cover an interval during which photofluorographic examinations were given routinely to all Navy and Marine Corps personnel as part of the physical examination to determine fitness for active duty or separation from the service, and at annual intervals while on active duty to all such personnel under the age of 30. Since September 1946, the annual examination has been required of all Navy and Marine Corps personnel.

The procedures followed were the same as those described in the initial report (1). That is, the data were taken from the Reports of Medical Survey received in the Bureau. Also, further information concerning each case was obtained from the health records of the individuals with pulmonary tuberculosis. These data were summar-

ized and processed to supplement the data on the respective medical survey report. In this study the observations covered the 4,234 survey reports submitted for members of the Navy and Marine Corps who appeared before Boards of Medical Survey in the interval 1 October 1945 to 1 October 1946 for reason of pulmonary tuberculosis. An adjustment was made to include such surveys that were held within the reported period even though these reports were received late in the Bureau.

TABLE 1.—*Comparison of number and percent of reports—medical surveys for pulmonary tuberculosis received during March 1944 to October 1945,¹ and October 1945 to October 1946, Navy and Marine Corps*

Diagnoses	Number		Percent	
	March 1944 to October 1945	October 1945 to October 1946	March 1944 to October 1945	October 1945 to October 1946
Total.....	3, 494	4, 234	100. 0	100. 0
Primary, active.....	10	18	. 3	. 4
Primary, healed.....	118	160	3. 4	3. 8
Minimal, active.....	415	566	11. 9	13. 4
Minimal, arrested.....	894	1, 475	25. 6	34. 8
Moderately advanced, active.....	1, 168	1, 179	33. 4	27. 8
Moderately advanced, arrested.....	348	324	9. 9	7. 7
Far advanced, active.....	532	496	15. 2	11. 7
Far advanced, arrested.....	9	16	. 3	. 4

TABLE 1 (a).—*Number and percent by diagnoses according to medical surveys for pulmonary tuberculosis, officers and enlisted, Navy and Marine Corps, October 1945–October 1946*

Diagnoses	Number			Percent		
	Total	Offi- cers	En- listed	Total	Offi- cers	En- listed
Total.....	4, 234	522	3, 712	100. 0	100. 0	100. 0
Primary, active.....	18	3	15	. 4	. 6	. 4
Primary, healed.....	160	16	144	3. 8	3. 1	3. 9
Minimal, active.....	566	79	487	13. 4	15. 1	13. 1
Minimal, arrested.....	1, 475	209	1, 266	34. 8	40. 0	34. 1
Moderately advanced, active.....	1, 179	129	1, 050	27. 8	24. 7	28. 3
Moderately advanced, arrested.....	324	56	268	7. 7	10. 7	7. 2
Far advanced, active.....	496	30	466	11. 7	5. 8	12. 6
Far advanced, arrested.....	16	—	16	. 4	0	. 4

ACTIVE—ARRESTED

Total.....	4, 234	522	3, 712	100. 0	100. 0	100. 0
Active.....	2, 259	241	2, 018	53. 4	46. 2	54. 4
Arrested.....	1, 975	281	1, 694	46. 6	53. 8	45. 6

Table 1 presents a comparison between the cases included in the first report (1) and those of the present study by form of pulmonary tuberculosis. It is to be noted that although the first interval was 6 months longer than the second, there was approximately a 20-percent increase

in case finding. In the first period the minimal form of the disease accounted for 37.5 percent of the total cases and compared to 48.2 percent in the second period. It is probable that the progress made through mass photofluorographic examinations explains the difference since minimal tuberculosis is almost exclusively discovered by x-ray.

There was a significant difference between officers and enlisted men in the activity and severity of the disease. In 42.6 percent of the officers the disease was active as against 54.4 percent of the enlisted men. The greater percent of cases were of the minimal, 48.2, and moderately advanced, 35.5, forms.

TABLE 2.—*Number and percent by age in years*

Number and percent	Age in years									
	Total	Less than 20	20-24	25-29	30-34	35-39	40-44	45-49	50 and over	Not stated
Number.....	4, 234	244	1, 556	999	631	395	227	116	59	7
Percent.....	100. 0	5. 8	36. 7	23. 6	14. 9	9. 3	5. 4	2. 7	1. 4	0. 2

TABLE 3.—*Number and percent of admissions to sick list by length of service and source of lesion*

Months of service	Source of lesion									
	Number					Percent				
	Total	Line of duty	EPTE aggravated	EPTE not aggravated	Not stated	Total	Line of duty	EPTE aggravated	EPTE not aggravated	Not stated
Total	4,234	3,716	101	412	5	100.0	87.8	2.4	9.7	0.1
Less than 1	9	7	4	9	-----	100.0	0	0	100.0	0
1	114	8	3	103	-----	100.0	6.1	3.5	90.4	0
2	35	24	7	24	-----	100.0	22.8	8.6	68.6	0
3-5	64	106	10	31	-----	100.0	37.5	10.9	51.6	0
6-11	147	704	33	110	-----	100.0	72.1	6.8	21.1	0
12-23	847	1,231	25	54	2	100.0	83.1	3.9	13.0	0
24-35	1,312	1,317	19	47	3	100.0	93.8	1.9	4.1	.2
36 or more	1,386	319	-----	1	-----	100.0	95.0	1.4	3.4	.2
Not stated	320	-----	-----	-----	-----	100.0	99.7	0	.3	0

Although they are not shown separately in the tables, 195, or about 5 percent, of the 4,234 patients appearing before Boards of Medical Survey for reason of pulmonary tuberculosis were Negroes, and 82, or approximately 2 percent, were personnel of other nonwhite races. The nonwhites contribute 5.2 percent of the population and 6.5 percent of the cases. The ratio between the whites and nonwhites in this group of cases and the race distribution of the entire Navy and Marine Corps in 1946 showed no significant difference in the prevalence of pulmonary tuberculosis among the nonwhite races. This was not in agreement with comparable data for the population at large or a previous study

of the Navy population (5) both of which indicated the prevalence of pulmonary tuberculosis in whites to be notably lower than that for the darker races.

From table 2 it may be seen that 66.1 percent of the 4,234 patients were less than 30 years of age although the latest age distribution for the Navy in 1946 showed that approximately 90 percent of the total personnel were less than 30 years of age. The observations indicate that tuberculosis in the Navy and Marine Corps is not primarily a problem only in the younger age groups. This fact has been previously pointed out in an earlier article (5). It is probable that the age of tuberculosis patients in the Navy will decrease as the photo-fluorographic and tubercular testing programs (6) are developed and chest x-rays become an accepted and vital part of the recruit and annual examinations.

The policy followed, whenever practicable, during the war years and the immediate postwar period, of including a chest x-ray as part of the recruitment or appointment examination has proved of inestimable value. It may be noted in table 3 that only about 12 percent of the total patients had acquired the disease, EPTE, or prior to entry into the service. Of these 513 EPTE cases, 101 or 19.6 percent were patients whose condition was aggravated by military service and the remainder (412 cases) were individuals who apparently were unaffected by naval service. In reality the former group (aggravated) had healed lesions at the time of entry that changed during the period of service to an active status. Even a casual glance at table 3 will show there are no great differences in length of service between the group of patients whose disease was determined to have existed prior to entry into the Navy and the other patients whose tuberculosis was contracted in line of duty after entry into the service. Of the former group about 20 percent had less than 2 years of service while only 25 percent of the cases incurred in line of duty for whom information was available had served less than 2 years at the time they were admitted for tuberculosis. There is some reason to question the efficacy of the data for all of the cases reported as having had less than 3 months' service. It is probable that these appeared as a result of reporting or processing errors.

Table 4 shows the number of days elapsing between the date of admission to the sick list and the date of the medical survey. Only 8 percent were on the sick list less than 1 month prior to survey while 85 percent of the cases were observed or treated for more than 7 weeks before a board of medical survey reviewed the case with the object of making a formal determination of the physical condition of the individual. Although the above comments are related to the entire group, it is apparent that the primary and minimal cases were surveyed earlier

than those with more advanced forms of the disease. Of the primary cases, 66, or 37.0 percent, were surveyed in less than 1 month while only 191 or 8.5 percent of the minimal cases were on the sick list for this same period before the survey. The fact that the time on the sick list increased indirectly with the severity of the disease was further emphasized when it was found that only 0.4 percent of the moderately advanced and just 0.2 percent of the advanced cases were surveyed before they had been on the sick list 4 weeks.

TABLE 4.—*Diagnosis by number of days on sick list prior to medical survey*

Diagnosis	Total	Days								Not stated
		0-7	8-14	15-21	22-28	29-35	36-42	43-49	50 or more	
Total.....	4,234	52	62	99	113	106	108	83	3,597	14
Primary, active.....	18	2	1	3	2	—	—	1	9	—
Primary, healed.....	160	18	18	15	7	9	10	5	78	—
Minimal, active.....	566	2	8	6	13	7	5	2	520	3
Minimal, arrested.....	1,475	20	15	50	67	75	75	64	1,103	6
Moderately advanced, active.....	1,179	1	12	9	5	5	4	2	1,137	4
Moderately advanced, arrested.....	324	7	6	11	15	8	12	7	257	1
Advanced, active.....	496	2	2	5	3	2	1	2	479	—
Advanced, arrested.....	16	—	—	—	1	—	1	—	14	—

TABLE 5.—*Number and percent by length of active duty and place of admission to sick list*

Length of active duty	Place of admission									
	Number					Percent				
	Total	United States	Ships	Foreign bases	Not stated	Total	United States	Ships	Foreign bases	Not stated
Total.....	4,234	2,740	951	537	6	100.0	64.7	22.5	12.7	0.1
Less than 1 year....	220	198	13	8	1	100.0	90.0	6.0	3.6	0.4
1 year.....	510	311	124	75	—	100.0	61.0	24.3	14.7	0
2 years.....	1,140	708	278	152	2	100.0	62.1	24.4	13.3	0.2
3 years.....	1,262	871	271	120	—	100.0	69.0	21.5	9.5	0
4 years.....	390	251	87	51	1	100.0	64.3	22.3	13.1	0.3
5 years.....	189	107	55	27	—	100.0	56.6	29.1	14.3	0
6 years.....	112	63	31	18	—	100.0	56.2	27.7	16.1	0
7 years.....	58	31	9	18	—	100.0	53.5	15.5	31.0	0
8 years and over....	353	200	83	68	2	100.0	56.6	23.5	19.3	0.6

Table 5 indicates that the number of cases related with length of service roughly parallels that for age. This confirms the findings of previous reports (1) (5). Of the total cases, 26.0 percent were on active duty 4 years or more prior to being admitted to the sick list for pulmonary tuberculosis. Of those individuals whose disease was noted during the first 6 months of their careers nearly all were discovered in the United States. This is to be expected because most men complete a training period prior to any assignment to ships and

foreign bases. As careers were extended beyond 6 months, an increasing number of cases was discovered on ships and foreign stations and conversely a small percent of the cases were in the United States.

Due to the changes in deployment of personnel during the war, from this data it cannot be inferred that the individuals contracted the disease as the result of duty in the specified area or ship at which admitted to the sick list. During the time of this observation the flow of Navy strength was back to the continental area. The majority of the cases grouped under the place of admission, "Foreign bases," were from Pearl Harbor and were discovered among the personnel from ships or among personnel in transit between points in the United States and stations in or beyond Hawaii.

TABLE 6.—*Number and percent by diagnosis and place of admission to sick list*

Diagnosis	Place of admission									
	Number					Percent				
	Total	United States	Ships	For- eign bases	Not stated	Total	United States	Ships	For- eign bases	Not stated
Total	4,234	2,740	951	537	6	100.0	64.7	22.5	12.7	0.1
Active	2,259	1,333	562	361	3	100.0	59.0	25.0	16.0	...
Primary, active	18	13	2	3	...	100.0	72.2	11.1	16.7	0
Minimal, active	566	368	129	67	2	100.0	65.1	22.8	11.8	.3
Moderately advanced, ac- tive	1,179	728	272	178	1	100.0	61.7	23.1	15.1	.1
Far advanced, active	496	224	159	113	...	100.0	45.2	32.0	22.8	0
Arrested	1,975	1,407	389	176	3	100.0	71.0	20.0	9.0	...
Primary, healed	160	123	27	10	...	100.0	76.9	16.9	6.2	0
Minimal, arrested	1,475	1,052	296	125	2	100.0	71.3	20.1	8.5	.1
Moderately advanced, ar- rested	324	222	61	40	1	100.0	68.5	18.8	12.4	.3
Far advanced, arrested	16	10	5	1	...	100.0	62.5	31.3	6.2	0

TABLE 7.—*Number and percent by diagnosis and source of lesion*

Diagnosis	Source of lesion									
	Number					Percent				
	Total	Line of duty	EPTE aggra- vated	EPTE not aggra- vated	Not stated	Total	Line of duty	EPTE aggra- vated	EPTE not aggra- vated	Not stated
Total	4,234	3,716	101	412	5	100.0	87.8	2.4	9.7	0.1
Primary, active	18	17	...	1	...	100.0	94.5	0	5.5	0
Primary, healed	160	55	6	99	...	100.0	34.4	3.7	61.9	0
Minimal, active	566	531	15	18	2	100.0	93.9	2.6	3.2	.3
Minimal, arrested	1,475	1,221	30	221	3	100.0	82.8	2.0	15.0	.2
Moderately advanced, active	1,179	1,128	31	20	...	100.0	95.7	2.6	1.7	0
Moderately advanced, arrested	324	273	4	47	...	100.0	84.3	1.2	14.5	0
Far advanced, active	496	475	15	6	...	100.0	95.8	3.0	1.2	0
Far advanced, arrested	16	16	...	...	...	100.0	100.0	0	0	0

From table 6 showing place of admission by form of tuberculosis, it may be noted that there are significant differences between the percent of all active cases discovered in the United States and the other two places.

TABLE 8.—*Number and percent by diagnosis and method of disposition*

Diagnosis	Method of disposition											
	Number						Percent					
	Total	Duty	Limited duty	Further treatment	I. S.	Other ¹	Total	Duty	Limited duty	Further treatment	I. S.	Other ¹
Total.....	4, 234	204	16	661	2, 950	403	100.0	4. 8	0. 4	15. 6	69. 7	9. 5
Active.....	2, 259	1	1	605	1, 386	266	100.0	0. 0	0. 0	26. 8	61. 4	11. 8
Primary, active.....	18	1		10	7		100.0	5. 5	0	55. 5	39. 0	0
Minimal, active.....	566			157	341	68	100.0	0	0	27. 7	60. 3	12. 0
Moderately advanced, active.....	1, 179			292	735	152	100.0	0	0	24. 8	62. 3	12. 9
Far advanced, active.....	496		1	146	303	46	100.0	0	. 2	29. 4	61. 1	9. 3
Arrested.....	1, 975	203	15	56	1, 564	137	100.0	10. 3	. 7	2. 8	79. 2	7. 0
Primary, healed.....	160	11	1	3	139	6	100.0	6. 9	. 6	1. 9	86. 9	3. 7
Minimal, arrested.....	1, 475	170	10	39	1, 160	96	100.0	11. 5	. 7	2. 6	78. 7	6. 5
Moderately advanced, arrested.....	324	22	4	14	249	35	100.0	6. 8	1. 2	4. 3	76. 9	10. 8
Far advanced, arrested.....	16				16		100.0	0	0	0	100.0	1

¹ Includes 49 officers released from service by means of separation points.

The comparison of diagnosis by source of lesion reveals that of all the cases 87.8 percent acquired the disease in line of duty. Of the 513 cases whose source of lesion was determined, EPTE, or to have existed prior to entry into naval service, 407 or 79.3 percent were arrested. The minimal arrested and moderately advanced active forms of the diseases accounted for 33.0 and 30.3 percent respectively of all the cases acquired as the result of naval duty. As would be expected in light of recruiting examination screening active cases, nearly all the far advanced cases were duty-contracted.

Upon decision by boards of medical survey approximately 70 percent of the total cases were invalided from the service and 16 percent were retained for further treatment. Of the patients with an active form of the disease over 61 percent were invalided from the service. However, this does not mean they were discharged into civilian life to become sources of contact or public wards. The larger portion represents those invalided from the Navy and immediately transferred to a Veterans' Administration facility for continued care. A few of those IS'ed preferred treatment in private sanatoria. The single active case going to duty is probably in error. The 203 (10 percent) arrested cases recommended to further duty will in most cases, eventually be invalided from the service.

Although the principal case-finding method is mass photofluorography, it has been pointed out (4) that it is only a screening method which must be followed by laboratory and clinical study before a diagnosis is established and treatment or disposition recommended. In table 9 is indicated the number of patients for whom examinations of sputum or gastric washings were reported and to whom the tuberculin test was given. Also presented is the number of patients whose records contained note of positive physical symptoms, history of contact with a known infected person, and a positive past history. Of the 4,234 cases, 90.5 percent or 3,831 (positive+negative) reported use of the sputum smear, 49.0 percent the use of gastric lavage and 16.6 percent the use of the skin test. The data is not clear as to the number of cases reported discovered by photofluorogram in which the diagnoses were substantiated by one or more of the laboratory tests. It is notable that 323 or 22.5 percent of the 1,433 whose history of contact was reported had been exposed to a person with a contagious form of the disease. From this clinical or laboratory data culled from the medical survey reports, and assuming complete reporting, it seems that full use is not being made of various positive techniques to firmly establish the diagnosis of tuberculosis.

TABLE 9.—*Various aspects of case history in report of medical surveys*

	Sputum	Gastric lavage	Skin test (tuberculin)	Physical sign	History of contact	Past history
Total	4, 234	4, 234	4, 234	4, 234	4, 234	4, 234
Positive	1, 703	290	645	651	323	193
Negative	2, 128	1, 789	60	1, 973	1, 110	1, 398
Not stated	403	2, 155	3, 529	1, 610	2, 801	2, 653

Over 61 percent of the total cases (2,608) were reported as having been discovered as the result of a photofluorographic examination of the chest. Thirty-six percent of the total cases reporting a photofluorographic examination stated that this technique was not responsible for the original discovery of the case.

TABLE 10.—*Number and percent by results of the preservice film reading*

Film reading at review	Number			Percent		
	Total	Officers	Enlisted	Total	Officers	Enlisted
Total	4, 234	522	3, 712	100. 0	100. 0	100. 0
Positive	576	22	554	13. 6	4. 2	14. 9
Negative	1, 327	64	1, 263	31. 4	12. 3	31. 0
Suspicious	325	11	314	7. 6	2. 1	8. 5
Unsatisfactory	25	1	24	. 6	. 2	. 6
Film not made or not available	1, 981	424	1, 557	46. 8	81. 2	42. 0

Table 10 reviews the results of the photofluorogram made before or soon after entering the service. Of the 2,228 instances in which a technically satisfactory photofluorogram of the chest resulted, 901, or 40.4 percent, showed abnormal shadows which, if confirmed by reexamination on a 14 by 17-inch film, would be considered cause for rejection of an applicant for enlistment or appointment. The remaining 2,006 cases had no preservice films or else had one taken which was technically unsatisfactory (25). It is probable that had preservice films been available for all personnel, and had the interpretation been perfect, the number of cases reviewed here would have been cut nearly in half.

SUMMARY

Four thousand two hundred and thirty-four reports of medical survey for Navy and Marine Corps personnel with pulmonary tuberculosis received in the Bureau of Medicine and Surgery during the period October 1945 and October 1946 with supplemental records contained in the health record file of the personnel with the disease have been reviewed and presented. The increase in the discovery by the photofluorographic technique of the minimal form of the disease was noted. Also reflected is the correlation between the increase in case finding and increase in the number of x-ray examinations. It is pointed out that there is a greater need for more detailed and intensive clinical and laboratory study of the patients to establish positively the true diagnosis when their photofluorograms, confirmed by reexamination on 14 by 17-film contain evidence suspicious of pulmonary tuberculosis or other disease. Those cases which then are determined to be of no present clinical significance may then be flagged for semiannual examination until all questions as to the health of the individuals concerned have been resolved.

REFERENCES

1. BRITTEN, S. A.; JORRIS, E. H.; HUGHES, D. W.; and ALLEN, M. F.: Medical surveys for pulmonary tuberculosis. U. S. Nav. M. Bull. 46: 936-943, June 1946.
2. BRITTEN, S. A.: Photofluorographic examination of chest of all Navy and Marine Corps personnel, 1944-1945. U. S. Nav. M. Bull. 46: 1479-1481, Sept. 1946.
3. BRITTEN, S. A., and CHARTER, W. V.: Routine photofluorographic examinations of Navy and Marine Corps personnel; end results. U. S. Nav. M. Bull. 47: 733-738, July-Aug. 1947.
4. HILLEBOE, H. E., and HOLM, J.: International control of tuberculosis. U. S. Public Health Reports 62: 1114-1128, Aug. 1947.

5. Medical Statistics Division, Bureau of Medicine and Surgery, U. S. Navy Department: Factors influencing incidence of tuberculosis. In Statistics of Navy Department, vol. 2, No. 9, p. 5, Sept. 1946.
6. BERTON, S. A.: Pulmonary tuberculosis; Review of 66 cases with anatomical findings. U. S. Nav. M. Bull. 48: 132-139, Jan.-Feb. 1948.



CONCENTRATION OF GROUPING SERUM FOR GROUP "A" HEMOLYTIC STREPTOCOCCI

JAMES T. PRINCE¹

Chief Hospital Corpsman, U. S. N.

During the past 18 months that we have been grouping and typing hemolytic streptococci, we have found that certain lots of serums had a low titer or that they had lost part of the titer due to length of storage or upon use failed to give satisfactory reactions when used in the Swift, Wilson, and Lancefield technique (1) for grouping of hemolytic streptococci.

The storage of dry immunological substances by lyophilization (2) (3) including antisera has been reported. However, there was found no record of the lyophilization of specific streptococci grouping sera. The principle of lyophilization was applied to certain unsatisfactory sera with a marked degree of success.

METHOD

Two to five cubic centimeters of the serum was lyophilized at a time. The tubes containing the sera were kept on the vacuum until the moisture content was reduced as much as possible and a relatively dry powder was obtained. The tubes were sealed with a flame while still under the vacuum and stored under refrigeration until ready for use.

The powder was dissolved in the following solutions and tested with known extracts prepared from cultures of group A, C, and D streptococci. The solutions were:

(a) Dilution with the same serum using 1 cc. of fluid serum to 2 cc. of the dried material, and 3 cc. of the fluid to 5 cc. of the dried serum.

(b) A sterile solution of buffered normal saline using sodium phosphate as the buffering agent with pH of 7. The dilutions were the same, 1:2, 3:5.

(c) Sterile buffered distilled water, using sodium phosphate as the buffering agent with a pH of 7, using dilutions 1:2, 3:5.

¹ From Epidemiology Unit No. 13, Medical Department, U. S. Naval Training Center, Great Lakes, Ill.

- (d) Sterile normal saline, 1:2, 3:5 dilutions.
- (e) Sterile distilled water, 1:2, 3:5 dilutions.

RESULTS

The use of the same sera for dissolving and diluting had a tendency to redissolve the powder very slowly, not completely dissolving the mass and leaving the solution in a jellylike state. When this was used in the precipitin test with capillary tubes, it appeared to be very milky. A moderate amount of precipitate appeared in the positive reactions, but due to the milky color of the sera the weak reactions could not be read satisfactorily.

When the buffered normal saline solution was added to the lyophilized sera, it dissolved very rapidly, but when used for grouping it gave all false positive reactions. The buffered sterile distilled water and sterile normal saline gave the same results.

Sterile distilled water dissolved the powders slowly but after being mixed and kept at approximately 38° F. for from 30 minutes to 1 hour, complete solution was obtained. This was then centrifuged and found to be highly satisfactory and of a very high titer. Negative reaction were obtained when used against known group C and D streptococcal extracts.

The redilution factor depends on the titer of the sera before lyophilization and must be determined in each lot of serum for concentration by running several dilutions of the dry sera against known group A streptococcal extracts.

SUMMARY

Out-dated streptococcal grouping sera and sera with low titers can be made usable and of a sufficient titer to carry out the grouping of streptococci by the Lancefield technique. This is done by lyophilization of the sera and rediluting with sterile distilled water in amounts less than the original volume. The mixture is placed in the refrigerator at 38° F. for from 30 minutes to 1 hour or until completely dissolved, centrifuged and used in the technique as described by Lancefield. A heavy precipitate was obtained against known group A streptococcal extracts and negative results against groups C and D streptococcal extracts.

REFERENCES

1. SWIFT, H. F.; WILSON, A. T.; and LANCEFIELD, R. C.: Typing group A hemolytic streptococci by M precipitin reactions in capillary pipettes. *J. Exper. Med.* 78: 127-133, Aug. 1943.
2. MASUCCI, P.: *J. Lab. & Clin. Med.* 31: 340.
3. GADWAHL, R. B. II.: *Clin. Lab. Methods & Diag.* 1: 781.



OUTBREAK OF SCARLET FEVER AND SORE THROATS
ABOARD THE U. S. S. OREGON CITYRALPH R. TYSON¹

Lieutenant, Junior grade (MC) U. S. N. R.

The U. S. S. *Oregon City* had been moored in the Boston Naval Shipyard since early January 1947. During the month of February many rated men as well as men fresh from training camps were reporting on board.

The weather had been changeable, and on the last week-end in February, heavy snows fell. On the first week-end in March there were very heavy rains; so much so that liberty parties returning on Sunday were drenched by the time they got on board the ship. The complement was approximately 500; there were 13 men in the medical department and 1 medical officer.

COURSE OF THE OUTBREAK

On Wednesday evening 26 February 1947, the first case of scarlet fever was diagnosed. The man reported to sick bay with an erythematous rash of his ankles and legs. He was obviously very sick and had a temperature of 103° F. He was immediately transferred to the hospital, where by morning, he presented the typical picture of scarlet fever. This man was about 20 years of age, was in the "S" Division and worked in the laundry.

The following day two men reported to sick bay with a sore throat and fever. They were in the "I" and "BM" Divisions. Penicillin was started immediately as treatment. At this time a careful inspection with special instructions was given to all food handlers.

The second day following the initial case of scarlet fever two more men from the "II" and "N" Divisions reported to sick bay with sore throats and fever. Penicillin was started immediately.

On the third day nine men were sent to the hospital on suspicion of scarlet fever. Of these nine, four had scarlet fever, the others did not. These four were the last cases of scarlet fever. Of these nine men, five were from the "S" Division, two from the "III" Division, and one each from the "I" and "R" Divisions. Of the four cases of scarlet fever, three were from the "S" and one from the "III" Divisions.

On the fourth day there were 15 admissions to sick bay with sore throats and fevers. (See figure 1 for breakdown.)

On the fifth day there were 14 admissions to sick bay with sore throats and fevers.

¹ Inactive.

Page 66
No. TABLES

SORE THROATS

TABLE I
No. Days After 1st Case of Scarlet Fever

	1	2	3	4	5	6	7	8	9	10	Total
1 st	1		1*								2
2 nd		1		3							4
3 rd				1	6	1	1				9
FI					2			2		1	5
RE				2	4	2					8
BM	1				3	2					6
S			2*	2	2	1					7
N			1*		1	3	1	1			7
R			1	2	1			1			5
S&M								1	1		2
H											0
Total	2	1	5*	10	19	9	2	5	1	1	55

NOTE - ALL ADMISSIONS ON 3rd DAY WERE TRANSFERRED TO U. S. N. H.

Figure 1.

The sixth day brought nine admissions to sick bay, the seventh only one, with three on the eighth and two on the ninth, all having sore throats and fevers.

PREVENTIVE MEASURES

The night of the third day after the initial scarlet fever case and the same day that nine more persons were sent to the hospital, sulfa-

diazine was given to all members of the "S" and "III" Divisions as well as medical inspection. These divisions were chosen first as they seemed to be the focal point. The dosage of sulfadiazine given was 2 grams initially, followed by 1 gram four times a day. This dosage was used throughout. This same evening all hands were restricted to the ship. This was maintained until the end of the outbreak.

The following morning all hands were inspected by the medical officer for fever and sore throats. This was done twice daily for the duration. Sulfadiazine was started for the rest of the crew. The men returning from liberty were sent to sick bay for their initial doses of sulfadiazine. Special watches were stood in the scullery and galley by C. P. O.'s to insure proper handling of food and utensils. All utensils were run through the dishwashers twice, the steam temperature being 190° or higher. All coffee makers, outside of those attached to a mess, were secured and movies were stopped. All of these precautions were maintained until the restriction was lifted on the seventh day.

By use of the loudspeaker system, the crew was notified of the necessity of reporting to sick bay if they did not feel well. They were also informed of the necessity of drinking at least 3 quarts of water daily.

SICK BAY

All men having a sore throat, fever, cold and fever, or malaise and fever, were admitted to sick bay. They were questioned as to the nature and duration of their symptoms. They were examined for a sore throat, adenopathy, skin rash, and mucous membrane rash. Their treatment was uniform and consisted of penicillin 50,000 units stat. and 30,000 units every 3 hours; the intramuscular route was used. Acetylsalicylic acid 10 grains every 3 hours and fluids were forced. Prior to discharge the patient was required to have had a normal temperature for 24 hours without penicillin in addition to having no further evidence of infection on examination. After discharge from sick bay they were not permitted to leave the ship for 2 days.

On the fifth day following the initial case of scarlet fever, sick bay was filled to capacity. An empty compartment with a water closet and washroom near sick bay was rigged with 10 bunks and 10 patients showing the most improvement were moved from sick bay to this new

	1	2	3	4	5
1	1	2	3	4	5
2	1	0	0	3	4
3	0	0	0	1	1
4	1	0	0	4	5
5	1	0	0	4	5

Figure 2.

compartment. The following day it became necessary to rig 10 more bunks and move 10 more patients.

During the nights of the third and fourth days, the medical department personnel divided itself into four 3-hour watches; this meant three watches of three men each and one watch of four men each. On the fifth day three men were assigned to night duty from 2100 to 0700 and while the load was heavy four day men stood a 2½-hour watch each. This enabled us to have two men in each compartment at all times. This latter method proved satisfactory in that it gave the hospital corpsmen more undisturbed rest and at the same time fully covered the needs of the situation. It should be added here that the medical department personnel met the demands of the emergency coolly, properly, and quickly. It is proof of their ability, and a credit to them, that they could do this.

CLINICAL COURSE OF PATIENTS

In the great majority of cases the symptoms consisted of malaise, cold, a chilly feeling with or without a sore throat. On examination of the upper respiratory tract the findings uniformly consisted of a hyperemic oral pharynx which extended onto the soft palate, hyperemic nasal mucous membranes and moderate discreet cervical lymphadenopathy usually involving only the posterior cervical chain but sometimes involving the anterior group. Other than a fever and a slight cough the physical findings were negative.

Either on admission or 4 to 8 hours later the typical patient registered his highest temperature. In only about three cases did the maximum temperature reach 103° F. The average highest temperature was 102° F., and the minimum elevation was 99° F.

After 12 hours of treatment the patient began to sweat profusely and within 4 hours his temperature reached normal, usually remaining there until discharged. There were 8 of the 50 cases treated who did not respond in this manner. In these cases the fever either subsided slowly or spiked several times before reaching normal. In no case was definite tonsillar involvement seen and only about half of the cases had hypertrophic tonsils. The average number of days in sick bay was 4, the maximum 7, the minimum 3. The percentage of Negro to white was the same as the percentage on board. On discharge, all symptoms and physical findings had disappeared, except in a few cases which had 1 or 2 enlarged cervical glands still remaining.

TOXIC REACTIONS

The number of sulfadiazine reactions was 5. The number of persons receiving sulfadiazine was 500, giving a percentage of 1 percent.

Every man received about 12 grams of sulfadiazine over a 3-day period. The reactions consisted of three with skin rashes of varying degree, from involving the trunk, to just one forearm, to a small patch in one elbow flexure. The other two consisted of chills and a spiking fever. In none of these cases was the reaction severe nor was the duration more than 36 hours.

One penicillin reaction consisting of giant hives was encountered. This man had received penicillin before. His hives responded promptly and ended with one injection of epinephrine.

There were two crew members who claimed to be sensitive to sulfadiazine. In these two cases none was given for prophylaxis. They were watched closely for the development of a sore throat but neither was involved in the outbreak.

COMMENTS

It is interesting to note how the outbreak started. The first sick patient had scarlet fever. He was in the "S" Division and worked in the laundry. No other laundryman was sick. In the next 2 days four men were admitted for sore throats from four different divisions. The "III" Division had the most cases; it was the only division berthed on the second deck and had its own head. It had its first case of sore throat on the third day and one of the five scarlet fever cases the same day. On the fourth day six men in the division were admitted for sore throats. The "S" Division which had the first case of scarlet fever and four of the total five cases of scarlet fever was surprisingly low in the number of sore throat cases, yet was one of the largest divisions on board and had its own head.

The stewards mates who live separately and more than 75 percent of whom eat in general mess only had two men involved, both having sore throats and neither eating in the general mess. These cases constituted stragglers, being admitted on the eighth and ninth days.

There was one officer and C. P. O. treated for sore throat. The officer was in the "II" Division which was lightly hit and the C. P. O. worked in the machine shop.

The only division not involved was the "H" Division. Yet they were constantly exposed and ate in the general mess.

Twenty-five men who received prophylactic treatment nevertheless were admitted for sore throats. The minimum sulfadiazine dose in these was 3 grams; the average, 8 grams; and the maximum, 12 grams. No person who received sulfadiazine developed scarlet fever nor did anyone treated for a sore throat with penicillin develop scarlet fever. The last scarlet fever case was before prophylaxis was started.

It was estimated from the bidaily examinations of the crew that more than half had colds. In follow-up daily it seemed that the number of sore throat admissions diminished as did the colds.

There was a definite correlation between age and sore throats. More than half were in the 16 to 20 year group and one-quarter were in the 20 to 25 year group. However, the age of the crew in general is young.

From reviewing all of the evidence at hand it seems highly improbable that spread was by food or water and that the most likely mode of transmission was direct contact or droplet in nature. It is felt that the poor weather predisposed greatly to the outbreak and that the ultimate origin was from a new man who was a carrier.



R11
255

20

UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 48

NUMBER 5



SEPTEMBER-OCTOBER 1948

Bimonthly

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED P-112

Digitized by

Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

A scene in the pharmacy, United States Naval Hospital, National Naval Medical Center, Bethesda, Md. Shown filling capsules is Edward A. Ambrose, Chief Hospital Corpsman; in the background is Willie B. Hickey, Hospital Corpsman, second class.

—Official U. S. Navy Photo.

Vol. 48

SEPTEMBER-OCTOBER 1948

No. 5

UNITED STATES NAVAL MEDICAL BULLETIN

**THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**



BIMONTHLY

**DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY**

Compiled and published under the authority of
Naval Appropriations Act for fiscal year 1949,
Public Law No. 753, approved June 24, 1948

**UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1948**

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.



Because the supply of certain numbers of the BULLETIN is exhausted and because of the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, No. 5.

Volume 17, 1922, No. 4.

Volume 18, 1923, Nos. 1, 3, and 5.

Volume 19, 1923, No. 3.

Volume 20, 1924, No. 5.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, No. 1.

Volume 26, 1928, Nos. 1 and 3.

Volume 31, 1933, No. 3.

Volume 42, 1944, Nos. 2 and 6.

Volume 44, 1945, No. 6.

March 1946 Supplement.

Volume 47, 1947, No. 6.

March-April 1948 Supplement.



SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$2.50; foreign subscription, \$3.25.

Single number, 50 cents.

Exchange of publications will be extended to medical and scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE



The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

CLIFFORD A. SWANSON,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS



Contributions to the **BULLETIN** should be typewritten, double-spaced, on plain paper of standard letter size and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions and the style laid down in the Government Printing Office Style Manual for spelling, abbreviations, capitalization, and the use of figures.

All pictures should be unmounted. Do not cut out portions of illustrations to be reproduced. Photographs should be black and white glossy prints, preferably 4 by 5 or 8 by 10 inches to allow for reduction. Do not make any marks on face of photograph nor type or write on back as these impressions show through and may mar the picture. Staples, paper clips, or pins should not be used on illustrations. All charts and graphs must be drawn with black India ink on white paper. If graph lines are to appear they should be in other than blue printing ink.

Contributions are to be the original work of the author and great care should be exercised to enclose in quotation marks quotations which may be introduced. Full credit for the source for these quotations should also be given. Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the **BULLETIN** should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

JOSEPH L. SCHWARTZ, *Editor,*
Captain, Medical Corps,
United States Navy.

TABLE OF CONTENTS



	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

General Principles and Purposes of Tracer Studies—Chalmers L. Gemmill	649
Importance of Leprosy in Orthopedic Surgery—John W. Metcalfe	656
The Use of Curare in Anesthesia in a United States Naval Hospital—Charles W. Reynolds	668
Analysis of Submarine Food Problems in World War II—Charles W. Shilling and Ivan F. Duff	683
Dental Observations of Native Puerto Ricans With Special Reference to Their Habits of Citrus Fruit Consumption—William A. Newman	698
Tuberculosis Program on Guam Including an All-Island Tuberculin Patch Test Study—Harold Jacobziner	700
Venereal Disease Among Naval Prisoners—Lawrence Z. Freedman	722
Primary Splenic Neutropenia With Concomitant Lymph Node Changes—Luther G. Bell and Robert L. Fleck	729
Herpes Zoster Following Exposure to Varicella; Treatment of Herpes Zoster With Cowpox Vaccine—Samuel H. Horton, Jr.	742

NAVAL MEDICAL HISTORY

A Wartime Log of the United States Naval Hospital Ship "Solace" From June 1943; Part II—Eugene H. Drake, William W. Strange, Howard B. Sprague, and Arthur P. McGinty	750
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

EDITORIALS

The Ten Greatest Advances in Medicine	769
What Makes a Disease Important?	770
Medical Ethnology and the Naval Medical Officer	771
Reactions to Suture Material	771

	Page
NOTICES OF DEATHS IN MEDICAL AND DENTAL CORPS.....	772

CLINICAL NOTES

Repair of Acquired Forehead Defects by Tantalum Cranioplasty and Plastic Surgery; Report of Two Cases— <i>John T. Giannini, Edgar N. Weaver, and Edward Kloos</i>	773
Metastatic Brain Abscess Originating in the Lungs Treated With Massive Doses of Penicillin; Report of a Case— <i>Thomas I. Hoen, Robert K. Anderson, and Frank B. Clare</i>	778
Mesothelioma of the Peritoneum— <i>Bruce H. Smith, Jr.</i>	781
Rapid Healing of a Perforating Peptic Ulcer Following Vagotomy; Report of a Case— <i>Ferrell H. Johnson and Edward A. Kearney</i>	792
Spontaneous Chylous Ascites; Report of a Case— <i>Lewis L. Haynes</i>	794

MEDICAL AND SURGICAL DEVICES

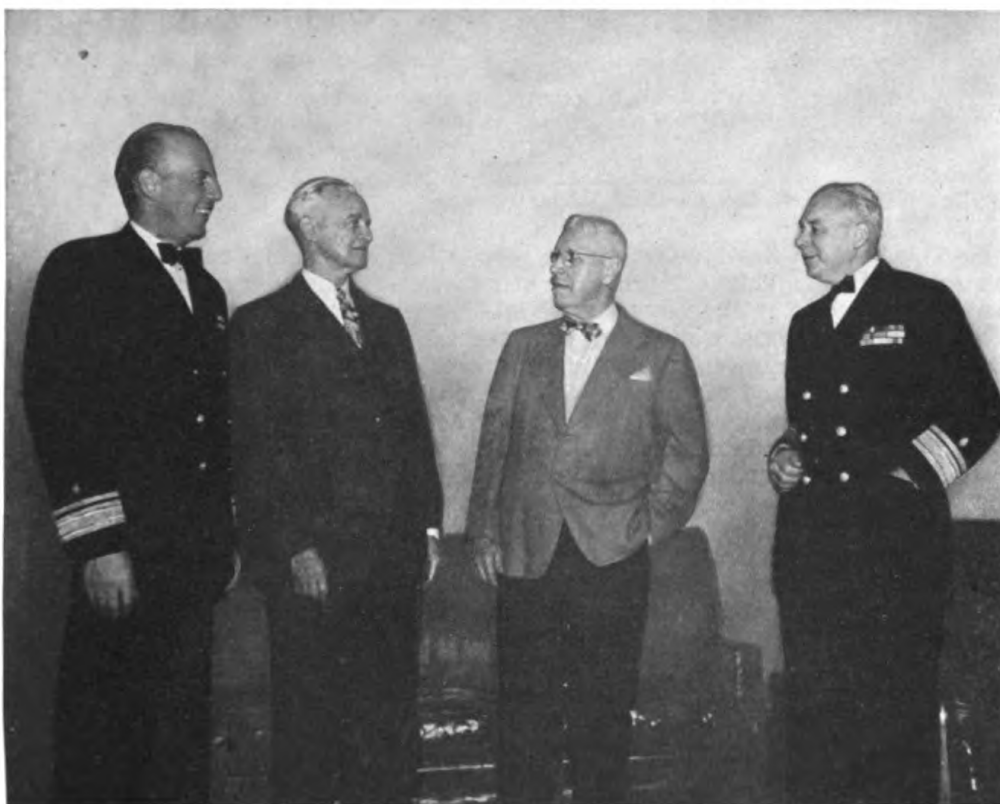
Two Methods for Application of DDT in the Field— <i>Eugene R. Hering and James F. Griffin</i>	797
-----------------------------------------------------------------------------------------------------	-----

BOOK NOTICES

Physical Medicine in General Practice, <i>edited by Watkins</i> —Handbook of Treatment and Medical Formulary, <i>Gruber</i> —Psychiatry in a Troubled World, <i>Menninger</i> —The Acute Infectious Fevers, <i>Joe</i> —Histopathology of the Ear, Nose and Throat, <i>Eggston</i> —George Crile, An Autobiography, <i>edited by Crile</i> —Arthritis and Related Conditions, <i>edited by Bach</i> —Surgical Applied Anatomy, <i>Treves</i> —Rheumatism and Soft Tissue Injuries, <i>Cyriax</i> —An Introduction to Dermatology, <i>Walker and Percival</i> —Stethoscopic Heart Records, <i>Geckler</i> —Private Enterprise or Government in Medicine, <i>Bauer</i> —Clinical Studies in Psychopathology, <i>Dicks</i> —Medicine Today, The March of Medicine, <i>compiled by the Committee on Lectures to the Laity, New York Academy of Medicine</i> —Synopsis of Pediatrics, <i>Zahorsky and Zahorsky</i> —Synopsis of Physiology, <i>Main</i> —Synopsis of Allergy, <i>Alexander</i> —Synopsis of Obstetrics, <i>Litzenberg</i> —Synopsis of Materia Medica Toxicology and Pharmacology, <i>Davison</i> —Synopsis of Operative Surgery, <i>Mobley</i> —The Natural History of Disease, <i>Ryle</i> —Ophthalmology in the War Years, Vol. 2, <i>edited by Wiener</i>	803
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

PREVENTIVE MEDICINE

Mass Photofluorography in a Naval Shipyard— <i>McHille J. Aston and William D. Loeser</i>	809
Bacillary Dysentery— <i>Richard Williamson, Roger Fuller, Frederick J. Martin, and Henry Tuchewicz</i>	818



At the recent symposium held at the National Naval Medical Center, Bethesda, Md., attended by district medical officers, fleet surgeons, and medical officers in command of naval hospitals; the Surgeon General of the Navy, Rear Admiral C. A. Swanson (MC) and the Deputy Chief of the Bureau of Medicine and Surgery, Rear Admiral H. L. Pugh (MC), were photographed with two former Surgeons General, Rear Admiral C. E. Riggs (MC) and Rear Admiral P. S. Rossiter (MC).

ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO No.



WASHINGTON 25, D. C.



20 September 1948

Fellow Officers of the Medical Department:

The Medical Service Corps was established by Act of Congress in August 1947. This Act provides in part for commissioning graduate pharmacists in the Navy and Naval Reserve.

There is a definite need for professional pharmacy services in the Medical Department. At major hospitals, large dispensaries, in various schools, and in certain technical and administrative fields, the services of pharmacists with modern scientific and professional training are really indispensable.

The changing order of medical practice and research places new demands upon pharmacy. Full medical care must embrace, to an ever increasing degree, the contributions of all of the professional services which support and supplement medicine.

Modern pharmacy is an exact science. The welfare of patients is frequently dependent in part upon the precision and efficiency of the services of pharmacy. Our pharmacies, in continental activities alone, filled over two and a half million prescriptions and ward drug orders during 1947. To this impressive number must be added a substantial volume of pharmaceutical services on ships at sea and on foreign stations.

An analysis has been made of our present pharmacy services and a progressive pharmacy program has been carefully planned. When this program is in full effect we will have throughout the Navy a pharmacy service that will parallel the present high standards of naval medicine.

A handwritten signature in cursive script, reading "C. A. Swanson".

Rear Admiral, Medical Corps
Surgeon General, U.S. Navy

U. S. NAVAL MEDICAL BULLETIN

VOL. 48

SEPTEMBER-OCTOBER 1948

No 5

*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



GENERAL PRINCIPLES AND PURPOSES OF TRACER STUDIES²

CHALMERS L. GEMMILL

Captain (MC) U. S. N. R.

IN ORDER to understand the role of radioactive tracers in metabolic processes, it may help to review the classical approaches to metabolism and to see how the use of radioactive substances has aided our knowledge. The first studies of metabolism were made by measuring the utilization of oxygen and the output of carbon dioxide. Considerable information was obtained by this method concerning the metabolic activity of the body. However, nothing could be gained concerning the action of individual organs by this method. The next approach was to study the chemical constituents of blood and urine. Again, considerable information was obtained, but a closer analysis of chemical changes in organ systems was needed. This was obtained from the introduction of organ perfusion studies and the tissue slice technique. At the present time, practically every laboratory doing metabolism studies is supplied with a Warburg apparatus

¹ The policy of the U. S. NAVAL MEDICAL BULLETIN as printed on the cover of its first issue and maintained throughout the 41 years of its existence.

² Paper presented 23 February 1948 at U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md., during the course on Medical Aspects of Radioactivity.

for the latter purpose. In order to carry our knowledge of metabolic transformation down one more step, enzymatic studies were made in which single systems were isolated and their activity determined. The great development of all this work came when it was discovered that some of the vitamins were constituent parts of enzymes, for now two great fields of endeavor were shown to have a common meeting ground.

Although much information has been gained by these methods, they have their limitations, for they are of value only if there is a marked accumulation or decrease of the substance in question. For example, if a substance A under study is given to an animal and appears as such in the excreta, and the concentration of A does not change in the body, there is no way of telling if A entered into dynamic equilibrium with body tissues or passed through as an inert substance. However, if A is tagged, and the tagged substance is found in the tissues, it is obvious that a dynamic interchange has taken place. This method was used extensively by Schoenheimer and his associates with the stable isotopes of hydrogen and nitrogen. Out of their work has come the idea that all tissues are in dynamic equilibrium with the ingested foodstuffs. There is no such thing as endogenous metabolism of the formed tissues and exogenous metabolism of the ingested foodstuffs. Both tissues and foodstuffs supply a common "metabolic pool" in which metabolites are coming from the tissues, from the foodstuffs and going to the tissues and the excreta. This remarkable discovery could have been made only with the use of isotopes as tracers.

Another use of isotopes has been to trace a substance so common in the body that its identity is soon lost. Tagged carbon in carbon dioxide has been shown to be taken up chemically by the liver. This assimilation of carbon dioxide by a tissue could have been discovered only through the use of isotopes. Therefore, a substance, carbon dioxide, generally thought of only as a waste product, can reenter a metabolic cycle.

Another use of tracers has been to study the shifting of a chemical group between various compounds. If the group is tagged on one molecule and then appears on another it is obvious that a shift has occurred. The total amounts of the two substances may not change and therefore the classified approach to metabolism would give no information of this change. The rapid shifting of the amino group and the methyl group are examples of information which have come from tracer studies.

In dealing with very small metabolic changes, tracer studies have been very valuable. It has been debated for a long time whether the body can metabolize the benzene ring. Tracer studies have shown that benzene ring can be opened and muconic acid formed, although only in very small amounts.

A great field for tracer studies has been the localization of chemical substances in the body. Iodine in the thyroid, the distribution of phosphorus in the body after ingestion, the affinity of tissues for certain drugs are a few examples in this field. One of the subdivisions of this approach has been radioautographs, in which localization has been obtained by placing a photographic film over the tissue. This is a fertile field of investigation. For example, if one wishes to find out the site of action of a tagged barbiturate, the drug could be given and serial sections made of the brain stem. By radioautographing each section, a good localization of the site of action of this drug could be obtained. The possibilities of this field are endless, but the technique needs improving in order to get better definition.

Another use of isotopes has been to measure the permeability of a cell membrane to the ion under question. This is a very valuable approach to this problem of general cellular physiology. It must be kept in mind, however, that a substance may diffuse readily into the extracellular fluid and not penetrate the cellular wall. Therefore, results on whole tissues must be subdivided into the amounts of the ion in the extracellular fluid and in the cell itself.

Another application in man has been the use of radioactive sodium in the diagnosis of peripheral vascular disease. The diagnostic importance of this method cannot be evaluated at the present time, for it has been used by only a few workers. However, the preliminary reports look very promising.

The tracing of a radioactive gas through the body for the purpose of measuring the diffusion through the lungs and tissues is another great field for experimentation. Valuable information has come and will come from these studies. These are a few of the many examples of the use of isotopes as tracer substances.

Isotopes have been discussed as tracers in a general way without defining "what is a tracer substance?" It is a substance tagged with a stable or radioactive isotope, and used in such dilution that it causes no apparent change to normal metabolism or destruction of body tissues. It is thought that the tagged substance enters into the normal metabolic cycles and is not used or rejected on account of its tag. Such a definition is not without criticism. There have been opponents to the use of tracer substances who have stated that they are abnormal substances and do interfere with normal metabolism. Another factor not commonly considered is that when a particle or γ radiation is emitted, the element under study generally goes over to a new element. This must cause many metabolic surprises in the body, for P 32 forms sulfur, carbon 14 goes to nitrogen, iodine 131 to xenon, and iron 59 to cobalt (table 1). However, the great body of evidence is that tagged substances do enter into normal metabolism and can

be used for detection of metabolic events. The definition of a tracer substance differs from that of the therapeutic use of isotopes, for in the latter case apparent changes do take place.

TABLE 1.—*Methods of production and disintegration of isotopes of biological interest*

Production	Disintegration	Method
$_{16}^{32}\text{S} + {}_0^1\text{H}^1 = {}_{16}^{32}\text{S} + {}_1^1\text{H}^1$	$_{15}^{32}\text{P} = {}_{16}^{32}\text{S} + {}_{-1}^0\text{e}^0$	pile
$_{7}^{14}\text{N} + {}_0^1\text{H}^1 = {}_6^{14}\text{C} + {}_1^1\text{H}^1$	$_{6}^{14}\text{C} = {}_7^{14}\text{N} + {}_{-1}^0\text{e}^0$	pile
$_{52}^{130}\text{Te} + {}_1^2\text{H}^2 = {}_{52}^{131}\text{Te} + {}_0^1\text{H}^1$	$_{53}^{131}\text{I} = {}_{52}^{131}\text{Te} + {}_{-1}^0\text{e}^0$	cyclotron
$_{15}^{31}\text{P} + {}_1^2\text{H}^2 = {}_{15}^{32}\text{P} + {}_1^1\text{H}^1$	$_{15}^{32}\text{P} = {}_{16}^{32}\text{S} + {}_{-1}^0\text{e}^0$	cyclotron
$_{26}^{58}\text{Fe} + {}_1^2\text{H}^2 = {}_{26}^{59}\text{Fe} + {}_1^1\text{H}^1$	$_{26}^{59}\text{Fe} = {}_{27}^{59}\text{Co} + {}_{-1}^0\text{e}^0$	cyclotron

${}_0^1\text{H}^1$, neutron; ${}_1^2\text{H}^2$, deuteron; ${}_{-1}^0\text{e}^0$, electron or β particle; γ , gamma radiation. The number above the symbol of the element is the atomic weight; the number below the symbol is the atomic number.

The next problem to be discussed is "who should use radioactive tracers?" At various conferences, there seem to be two schools of thought. One group states that the work should be done only in large centers: Brookhaven, Chicago, Rochester, Army or Navy laboratories. If a man has a problem he should go to one of these laboratories or even send his problem for solution to a large established group. The other school of thought maintains that the use of isotopes is as easy and common as the use of the chemical balance. Every laboratory should have facilities for isotope work and use isotopes as the problems arise. From our experience, isotopes can be used in a small laboratory if facilities and money are available. It is essential that many individuals be trained in the use of isotopes in peacetime in order that they may advance this science. These trained individuals will also be of great help in a national emergency. However, an adequate permanent staff working on isotopes full time must be maintained. It is impossible to do part-time work with isotopes and they are not as easy to use as a chemical balance. The problems of procurement, handling, half-life decay and protection of the worker must always be considered. For a single problem it would be cheaper and better to go to a large established laboratory. If one wishes to have a continuous isotope program, then a small laboratory may be established and staffed. However, there are many delays in a small laboratory. If a Geiger counter does not perform properly, if something happens to the autoscaler or if shipments of the isotopes do not come on schedule, the small laboratory is handicapped by lack of sufficient equipment and maintenance service. Therapeutic use of isotopes should be kept in large centers where they are used continuously. For tracer work, the cost of apparatus should decrease and the design should permit interchange of equipment of one company with another in

order that a small laboratory may carry on an isotope program cheaply. The latter factor is a special problem in a small laboratory. If one counter is obtained from one company it is not interchangeable with equipment from another; therefore one is dependent on one firm for all equipment after the initial purchase. The use of stable isotopes demands the procurement of a mass spectrometer which costs from \$10,000 to \$25,000. Therefore stable isotope research is out of the question in the smaller laboratory. It can be done only in a large established center.

The next problem to be discussed is what radioactive isotopes are available for biological work. Theoretically the isotope must be obtainable in pure form and have (1) suitable half-life: (2) proper biological behavior; (3) proper chemical behavior; and (4) proper radiation spectrum.

The isotopes which have been used most extensively in biological experimentation are given in table 2. Practically, the small laboratory is limited to the isotopes obtainable in pure form from Oak Ridge unless the laboratory is near a cyclotron. These isotopes are carbon 14, iodine 131, phosphorus 32 and sulfur 35. Of these, carbon 14 with its long half-life of 5,000 years and the low energy of its beta radiation (0.145 m. e. v.) becomes a special problem. It must be kept in mind that the isotopes produced at Oak Ridge can be made only by neutron-induced reactions and therefore the supply is limited by this method. It may be of interest to follow the equations for the production of some of the common isotopes (table 1).

TABLE 2.—*Radioactive isotopes used in biological experimentation*

Element	Half-life	M. e. v. radiation
$^1\text{H}^3$	31 <i>y</i>	e^- (0.015)
^{14}C	5,000 <i>y</i>	e^- (0.145)
^{24}Na	14.8 <i>h</i>	e^- (1.4) γ (1.38, 3.73)
^{32}P	14.3 <i>d</i>	e^- (1.69)
^{35}S	88 <i>d</i>	e^- (0.120)
^{42}K	12.4 <i>h</i>	e^- (3.5)
^{52}Mn	6.5 <i>d</i>	e^+ (0.77) γ (1.0)
^{59}Fe	47 <i>d</i>	e^- (0.26, 0.46) γ (1.3, 1.1)
^{64}Cu	12.8 <i>h</i>	e^- (0.58) e^+ (0.66)
^{76}As	26.8 <i>h</i>	e^- (1.1, 1.7, 2.7) e^+ (0.7, 2.6), γ
^{82}Br	34 <i>h</i>	e^- (.465)
^{131}I	8.0 <i>d</i>	e^- (0.69)
^{199}Au	3.3 <i>d</i>	e^- (1.01) γ (0.33)
^{207}Bi	6.4 <i>d</i>	γ (0.93)

(*h*=hours, *d*=days, *y*=years, e^- =particle or electron, e^+ =positron, γ =gamma radiation, m. e. v.=million electron volts)

Data taken for the most part from J. M. Cook's, *Radioactivity and Nuclear Physics*, Edwards Bros., Ann Arbor, Mich., 1946. Values vary slightly in different publications.

The next and last general problem to be discussed is that of the quantitative detection of the amount of radioactive substance present in tissues. If only a qualitative study is to be made, the obtaining of the results is relatively easy; the radioactivity is either there or not. If the isotope under question gives off β particles or γ radiation of

sufficient intensity to activate a standard Geiger-Müller tube and counter, unbelievably small amounts of material may be detected. For example, 1 milligram of radium gives off 3.7×10^7 disintegrations per second. This number of disintegrations is termed a millicurie ($mc = 10^{-3}$ curies). Recently a rutherford has been introduced which is 1×10^6 disintegrations per second and a microrutherford which is 1×10^3 disintegrations). A count in tracer work may be around 37.0 per second (2,220 per minute) or less. This means that 1×10^{-6} milligrams or 1×10^{-3} micrograms of radium may be detected, if all the radiation passes into the counter. There is, however, only a small part generally picked up by the counter which would reduce this value by a factor of 10. However, to detect 0.01 microgram of a substance is a very sensitive analytical method and exceeds our microbalances at the present time. The problem is to make a quantitative determination of this disintegration rate. Many factors enter into its absolute measurement: background, absorption, geometry, type of counter, and degree of spreading on plate. A recent survey of counting methods was made by Dr. Curtiss of the Bureau of Standards who sent the same sample of I 131 to numerous laboratories. A large variation in values for this sample were reported by various laboratories. It is obvious that there is a great need for standard methods of determination of the absolute disintegration rate. On the other hand, fairly reliable relative counts in biological material may be obtained by treating the samples by identical methods. Disregarding the absolute rates, Dr. V. Pertzoff, in our laboratory, has been able to obtain relative counts on two samples of plasma which agree within 3 percent when radioactive phosphorus is added to whole blood and incubated for from 1 to 2 hours. Similar quantitative agreement can be obtained between two sets of muscles and other biological material. Therefore, with agreement as good as that value, quantitative work can be carried out with tracer isotopes on a relative basis.

SUMMARY

A general discussion has been given of isotopes as tracers in biological work. The types of isotopes available and the quantitative nature of this work has been discussed. It may be stated that isotopes are a valuable tool in metabolic research. There is still a great deal, however, that can be done with the classical methods. Isotopes are not the final answer to all problems, but aid greatly in obtaining many results not given by the classical methods.

GENERAL REFERENCES TO ISOTOPES

Physical

SMYTH, H. D.: Atomic Energy for Military Purposes. Princeton University Press, Princeton, N. J., 1945.

- WILSON, D. W.; NIER, A. O. C.; REIMAN, S. P.: Preparation and Measurement of Isotopic Tracers. J. W. Edwards, Ann Arbor, Mich., 1946.
- POLLARD, E., and DAVIDSON, W. L.: Applied Nuclear Physics. John Wiley and Sons, New York, N. Y., 1942.
- COOK, J. M.: Radioactivity and Nuclear Physics. J. W. Edwards, Ann Arbor, Mich., 1946.
- SEABORG, G. T.: Tables of Isotopes. Review of Modern Physics. 16: 1, 1944.

Biological

- KAMEN, M. D.: Radioactive Tracers in Biology. Academic Press, New York, 1947.
- ROSS, J. F.: Isotopes in medical investigation and therapy. New England J. Med. 228: 454, 482, 1943.
- HAMILTON, J. G.: The Use of Radioactive Tracers in Biology and Medicine. Radiology 39: 541, 1942.
- HALL, B. E., and WATKINS, C. L.: Medical use of radioactive isotopes; radioactive isotopes in hematologic disturbances and neoplasms. Am. J. M. Sc.: 213: 621-628, May 1947.
- KEATING, F. R., JR.: Medical use of radioactive isotopes; radio-iodine and thyroid. Am. J. M. Sc.: 213: 628-631, May 1947.
- WARREN, S.: The Therapeutic Use of Radioactive Phosphorus, Am. J. M. Sc. 209: 701, 1945.
- HALL, B. E.; WATKINS, C. H.; HARGRAVES, M. H.; GRIFFIN, H. Z.: Radioactive Phosphorus in the Treatment of Polycythemia Vera. Am. J. M. Sc. 209: 712, 1945.
- HERTZ, S., and ROBERTS, A.: Radioactive iodine in study of thyroid physiology; use of radioactive iodine therapy in hyperthyroidism. J. A. M. A. 131: 81-86, May 1946.
- SCHOENHEIMER, R.: The Dynamic State of Body Constituents. Harvard University Press, Cambridge, Mass., 1947 (reprint).
- BUCHANAN, J. M., and HASTINGS, A. B.: Use of isotopically marked carbon in Study of intermediary metabolism. Physiol. Rev. 26: 120-155, Jan. 1946.
- CHAIKOFF, I. L.: The Application of Labeling Agents to the Study of Phospholipid Metabolism. Physiol. Rev. 22: 291, 1942.
- SMITH, B. C., and QUIMBY, E. H.: The Use of Radioactive Sodium as a Tracer in the Study of Peripheral Vascular Disease. Radiology 45: 335, 1945.
- LOOFBOUROW, J. R.: Borderland Problems in Biology and Physics. Rev. of Modern Physics, 12: 267, 1940.
- GROSS, J.; LEBLOND, C. M.; and LEBLOND, C. P.: Histological localization of radioactive elements. Canad. M. A. J. 57: 102, 1947.



IMPORTANCE OF LEPROSY IN ORTHOPEDIC SURGERY

JOHN W. METCALFE
Commander (MC) U. S. N.

THE purpose of this article is to bring to the attention of the orthopedic surgeon the fact that because of the symptomatology of leprosy, the patient may first come to the orthopedist for diagnosis and treatment. Sloan (17) has reported in a series of 749 cases the incidence of presenting symptoms which might well bring the patient to the orthopedic clinic. (See table 1.)

TABLE 1.—Incidence of presenting symptoms of orthopedic scope¹

	Percent		Percent
Anesthesia.....	8.8	Painful hands.....	0.8
Muscle weakness.....	4.1	Wrist or foot drop.....	
Contracture of fingers.....	2.9	Sore arm.....	
Swelling of foot or leg.....	1.8	Painful ulnar nerve.....	
Atrophy of digits.....	1.2	Total orthopedic symptoms.....	20

¹ Abridged from SLOAN, N. R.: Early diagnosis of leprosy as seen in Hawaii. *Hawaii M. J.* 3: 111-120, Jan.-Feb. 1944.

In a series of 505 cases of leprosy Faget (5) reports the incidence of atrophy and contracture as 18 percent and bone changes in 28 percent. The early diagnosis of this disease must depend on a high index of suspicion which is predicated on at least a cursory knowledge of the disease.

Furthermore, the incidence of the disease in the temperate zone will probably increase following the mass migration of hundreds of thousands of troops through the highly endemic areas of the Orient, India, Near East, North Africa, and the Tropics in general. Witness the report of Porritt and Olsen (16) from Pontiac, Mich., of two simultaneous cases of leprosy in Marine Corps veterans who incurred their disease through the medium of the tattoo needle 21½ years previously in Melbourne, Australia. Cases may appear sporadically for the next decade or longer, even among children, for many families joined military personnel in endemic areas. In addition, the disease is mildly endemic in the southern part of Louisiana, Texas, and Florida.

ETIOLOGY AND TRANSMISSION

Although Koch's postulates have not been fulfilled, the etiology of leprosy is generally attributed to the *Mycobacterium leprae* described by Hansen. This organism is an acid-fast rod which stains somewhat more easily than that of tuberculosis and is best stained by cold methods instead of steaming carbolfuchsin. The Hansen bacillus tends to be shorter than the tubercle bacillus and is often found in clumps or globi. It has not been cultured on artificial media and human inoculation is successful inconstantly.

The precise transmission of the disease is unknown largely because of the long incubation period. In the case of the Marines previously mentioned, it was 2½ years, but the incubation period may extend to a decade. *M. leprae* is found in large numbers in the broken skin, nasal secretions, saliva, milk, blood, urine, semen, and ulcers of lepers. According to Hayata (9), experimentally the organism can pass through the unbroken skin of healthy rabbits. The close proximity of crowded living conditions is considered to be favorable for the spread of the disease.

As to theories of the transmission of the disease, the following are listed: (a) Person to person vaccination, e. g., open sores, finger puncture in surgery, and tattooing. (Convincing reports by Porritt and Olsen (16)). (b) Fish as an intermediate host. (c) Nasal secretions. (d) Sexual intercourse. (e) Insect vectors. (The latter deserves further consideration.)

According to Hayata (9) there is a definite relationship between the incidence of leprosy and the insect population. This author of many years experience in Okinawa, Formosa, and Japan states that acid-fast bacilli are frequently found in the intestinal tract of flies caught in the homes of lepers in Okinawa.

Muñoz Rivas (13), working in Bogota, Colombia, South America, has published an excellent treatise on the relationship of fleas, floors, leprosy, temperature, and humidity. In humid areas the dirt floors of leprous habitations are heavily infested with fleas. Acid-fast bacilli resembling *M. leprae* are found in high incidence in the intestinal tract of the fleas and even in the unfed larvae of the fleas. Furthermore, the incidence of fleas parallels the incidence of leprosy.

By repeated animal inoculations with an extract prepared from the infected flea larvae he was able to produce a disease in monkeys which bore a clinical resemblance to leprosy. A few acid-fast bacilli were recovered from the regional lymph glands of these monkeys during the dissemination stage, but at the time of necropsy no specific bacilli or pathognomonic lesion could be demonstrated.

In another paper Muñoz Rivas (12) reports on the extreme longevity

of the acid-fast group of bacteria. After exhuming the osseous remains of leprous cadavers buried 46 years he was able to culture acid-fast bacilli. The organisms, although of extreme longevity, were killed by heating to 58° C. for 15 minutes. As a control, cultures were made from the remains of indigents believed to be free from leprosy, and no acid-fast bacilli were demonstrated. These findings suggest that the disposition of tuberculous or leprous remains be cremation as the method of choice as a public-health measure.

PATHOGENESIS AND PATHOLOGY IN GENERAL

When the bacilli of leprosy enter the body, a sensitivity develops similar to that in tuberculosis. Lepromin, analogous to tuberculin, produces a similar reaction. In response to the bacilli, dead or alive, a characteristic proliferative reaction occurs, consisting of the infiltration of epithelioid cells, lymphocytes, and histiocytes. Later Langhans' giant cells appear. The further course of the disease depends largely on the resistance of the patient. Onset may occur at any stage and reactivation may occur later under stress of poor nutrition, exhaustion, repeated pregnancies, and adverse living conditions.

The progression of the disease occurs by spread along the lymphatics to the nerves and bone marrow. When the vascular system is reached bacteremia results with systemic seeding. Muñoz Rivas (11) reports 7 blood cultures positive for acid-fast bacilli in 200 cases of leprosy. The lepromin or Mitsuda reaction, according to Hayata (9), becomes positive at this time.

The essential pathology of leprosy is that of a chronic granuloma consisting of tubercle formation, proliferation of epithelioid cells, lymphocytes, histiocytes, foam cells, and Langhans' giant cells. Sometimes organisms are seen in the tissue and rarely caseation occurs. This specific granulation tissue in various admixtures of component elements infiltrates the skin, nerves, connective tissue, bone marrow, and viscera.

The benign tuberculoid form of the disease is characterized by a predominance of proliferative response with tubercle formation and few organisms in the tissue while the malignant lepromatous form shows a more diffuse less contained histology with xanthoma-like foam cells and numerous bacilli in the tissue.

CLINICAL CLASSIFICATION

From the early latent stage described under pathogenesis, in which systemic infiltration occurs, emerge two common types of leprosy: (a) tuberculoid or "neural" and (b) lepromatous or nodular.

(a) *The tuberculoid or "neural" form* is characterized by macular skin lesions hypo- or hyper-pigmented, sometimes violaceous, and



Figure 1.—*Interosseous atrophy and hand deformity.*



Figure 2.—*Clawhand and finger resorption.*



Figure 3.—*Destruction of digits.*



Figure 4.—*Skin nodules.*



Figure 5.—*Skin manifestation and contracture.*



Figure 6.—*Skin changes and alopecia without marked atrophy or contracture.*

predominance of peripheral nerve symptoms. The lepromin reaction is positive and organisms are scant in the tissue. Paresthesia is followed by anesthesia with a regular progression of loss of thermal sensation first, followed by that of light touch, pain, and deep touch perception in that order. The ulnar, peroneal, and great auricular nerves are most frequently involved. Palpable and visible thickening of the nerve occurs. Inhibition of perspiration is frequent. Muscle atrophy and paresis are sequelae. Wasting of the muscles of the thenar and hypothenar eminences is a common and fairly early sign. Later the intrinsic muscles of the hands and feet are affected. Paresis of the eyelid is a relatively early sign also. Corneal ulcers may occur secondarily. Facial paralysis, wrist drop and foot drop occur later in the disease.

Contracture of the fingers and toes may come about early, the little finger usually being the first affected, as a result of the predilection for involvement of the ulnar nerve clawing of the hand is typical; absorption of the bones of the digits is followed by retraction of the soft tissue, sometimes with the retention of the nail. Equinus develops in the foot for the peroneal nerve is most susceptible. Trophic ulcers, burns, and secondary infections are common and exceedingly resistant to treatment.

In this form, prior to the development of deformities, the prognosis for arrest is good. Early diagnosis and adequate treatment before permanent severe scarring of the nerve trunk has occurred, may salvage a patient from a life of misery and protect the general public.

(b) *The lepromatous, or nodular form* of leprosy, is characterized by red, elevated, granulomas beneath the skin and lepromas of the nerves, lymph nodes, and viscera. Bacilli are abundant in the tissue, neurological changes are variable, the lepromin test is negative and the clinical course is rapidly progressive toward deterioration. Acute exacerbations with bacillemia and fever, known as lepra reactions, are more common and severe in this type. Absorption of the nasal bones produces deformity or absence of the nose. A nodular pannus-like infiltration may develop over the eyes. Laryngeal stenosis is common occurring, according to Sloan (18), prior to chemotherapy frequently enough to require tracheotomy in 13 per cent of hospitalized patients. Death after great misery and deformity is frequently due to a superimposed tuberculosis or to kidney disease. These patients demonstrating bacilli in skin or secretions are "open cases" presumably infectious and must be segregated as a public-health measure.

PATHOGENESIS OF BONE AND JOINT LESIONS

As the result of hematogenous spread, children develop a leprous dactylitis most commonly at the adolescent period. One form is an osteochondritis of the proximal phalanges characterized by trans-

verse linear zone of atrophy at the epiphysis. This may regress with the closure of the epiphysis or may produce an arthritis deformans of the interphalangeal joint. In another form a leprosy osteomyelitis occurs which may be confused with tuberculous spina ventosa. Cyst-like changes may develop similar to the osteitis multiplex cystica of sarcoid. With progression of the disease the granulation tissue mass may enlarge to simulate enchondroma radiologically. The diagnosis depends on a high index of suspicion, a positive lepromin test, evidence of anesthesia and demonstration of the organism.

In the tuberculoid form disturbed nutrition due to nerve infiltration produces abnormal resorption and decalcification on a neurotrophic basis, according to Chamberlain et al. (3). Hayata states that osteoclastic activity is increased. Calcium and phosphorus metabolism is normal. Muscular contractures and atrophy usually precede bone changes which are late. The claw-hand results in atrophy and atrophy increases the clawing. The slow insensitive absorption occurs concentrically and according to Faget (5) is dependent upon the unequal involvement of neurotrophic and motor neurones. When the motor neurones escape trauma enhances the absorption. In the hand the terminal phalanges first are absorbed due to repeated traumata to



Figure 7.—(1) Pointing of second proximal phalanx; (2) notching of second metatarsal; (3) "sliced off" appearance of fifth metatarsal; and (4) loss of digits.



Figure 8.—(1) Absorption of terminal digits of hand, trauma; (2) subchondral cysts; and (3) thinning and sclerosis of shafts with narrowing of medullary cavity.

the insensitive but active digits, while in the feet the metatarsal heads and the proximal phalanges are first affected because they bear the brunt of weight bearing. When the motor neurone is involved principally, atrophy and contracture protect the terminal part of the digits and the knuckles become traumatized and develop absorptive and degenerative changes. Subluxations are not uncommon. According to Faget, Charcot joint occurs in the wrist and ankle in 1 per cent of a series of 505. Bone changes are rarely found above the wrist or ankle as the result of specific leprous reaction.

In the lepromatous form enlarged nutrient foramina of the peripheral bones of the hands and feet are believed to be due to a leprous infiltration of the nutrient vessels. Such has been shown histologically. Furthermore, defects in the peripheral digital arteries have been demonstrated by arteriograms. Primary aseptic necrosis of the bone may result from the specific endarteritis. Continued expansion of the granulation tissue into the marrow may produce a macroscopic cyst.



Figure 9.—(1) Ankylosis, right first interphalangeal joint; (2) subchondral cyst, left first interphalangeal joint; (3) spurring left first metatarsal-phalangeal joint; (4) destructive disorganization, right fifth metatarsal-phalangeal joint; and (5) enlarged nutrient foramen, right fourth proximal phalanx.



Figure 10.—(1) Concentric absorption, fourth metatarsals; (2) narrowing of marrow cavity in fourth phalanx; and (3) density of involved cortices.



Figure 11.—(1) Pointing "sucked candy-stick" appearance of fifth metatarsal; (2) subluxation, fourth metatarsal-phalangeal joint; (3) periosteal thickening, fourth metatarsal; (4) enlarged nutrient foramen and cyst, 4th midphalanx; and (5) epiphyses incompletely closed.

TABLE 2.—Roentgenological findings

Small peripheral lesions of fingers and toes:

1. "Notching" of tip.
2. "Sliced off" appearance.
3. "Fraying" of tuft.
4. "Collar button absorption" of short phalanges.
5. Enlarged nutrient foramen.

Joint lesions:

1. Subchondral cysts.
2. Degenerative and proliferative changes.
3. Ankylosis.
4. Subluxation.
5. Complete disorganization.

Larger lesions:

1. Transverse linear zone of rarefaction at phalangeal epiphysis—a leprous osteochondritis.
2. Cystic degeneration near nutrient artery of phalanx—a leprous osteomyelitis.
3. "Concentric bone atrophy" with narrowing of shaft without rarefaction. Thinning obliteration of marrow cavity with dense cortices.
4. "Pointing"—absorption of distal articulating surface of bone with "awl shaped" appearance, also likened to that of a "sucked candy stick."
5. Disappearance of digit or ray.

TABLE 3.—*Differential diagnosis*

Dermatologic conditions	Neurologic conditions	Other conditions
<ol style="list-style-type: none"> 1. Acne. 2. Adenoma sebaceum. 3. Erysipelas. 4. Erythemas. 5. Lichen planus. 6. Moluscum contagiosum. 7. Mycoses. 8. Neurofibromatosis. 9. Psoriasis. 10. Ringworm. 11. Sarcoid. 12. Scleroderma. 13. Sporotrichosis. 14. Syphilis. 15. Tuberculosis cutis. 16. Vitiligo. 17. Xanthoma. 	<ol style="list-style-type: none"> 1. Amytrophic lateral sclerosis. 2. Burn scars. 3. Causalgia. 4. Cervical rib. 5. Charcot-Marie-Tooth peroneal palsy. 6. Fracture deformities, spine. 7. Friedreich's ataxia. 8. Herniated intervertebral disk. 9. Nerve injuries. 10. Radiculitis. 11. Syringomyelia. 12. Tabes dorsalis. 13. Tumors, spinal cord. 	<ol style="list-style-type: none"> 1. Ainhum. 2. Arthritis. 3. Beriberi. 4. Buerger's disease. 5. Congenital deformities. 6. Diabetic gangrene. 7. Dupuytren's contracture. 8. Enchondroma. 9. Gout. 10. Neuritis (unclassified). 11. Osteochondritis. 12. Osteochondro-dystrophy. 13. Osteitis multiplex cystica. 14. Pelagra. 15. Raynaud's disease. 16. Spina ventosa. 17. Tuberculosis dactylitis.

Figure 12.—*Is this leprosy?*

DIAGNOSIS

The differential diagnosis of leprosy must of necessity include a wide variety of diseases which are listed in table 3. As an example of the confusion in diagnosis which might easily come about, examine figure 12. Is this leprosy? The "pointing" and "fraying" and absorption of the digits is compatible with the diagnosis. Anesthesia was present and was associated with foot drop. Further examination, however, revealed early Charcot joints involving the knees and a marked healed fracture deformity of the lumbar spine.

The specific diagnosis depends upon the demonstration of the Hansen bacillus which is best done by the technique of making a small oblique incision in the skin at the border of the pigmented or anesthetic area with a razor blade and scraping a drop or two of serum for acid-fast staining. Smears taken from lesions on mucous membranes may also show acid-fast bacilli. Biopsy can be made as a last resort but is not as reliable as the "skin snip" method described above. Paraffin tissue sections should be prepared according to the cold staining method of Fite (8). A presumptive diagnosis may be made on clinical findings which are characteristic. Anesthesia, particularly thermal, and/or the *Mycobacterium leprae* must be demonstrated to diagnose leprosy.

TREATMENT AND PROGNOSIS

Compulsory segregation of "open cases" in leprosariums where general hygienic treatment prevails similar to that of a tuberculosis sanatorium has done much to decrease the incidence of leprosy. Noninfectious patients are treated as out-patients in endemic areas. Modern treatment consists in the administration of sulfone drugs which in recent years have shown most encouraging results even in advanced cases. Promin is administered intravenously daily in 1-gram doses. The dose is gradually raised, depending upon the patient's tolerance. Diasone, another sulfone, is administered orally 1 gram daily in divided doses. Promizole is a similar drug which can be given by mouth and is reportedly less toxic. Older treatment has been abandoned.

Reports are extremely encouraging about the prognosis of these patients under the new forms of treatment. Lesions regress, bacilli diminish in number, healing of some lesions occurs, exacerbations are less frequent, the death rate has decreased and the number of arrested cases has increased.

SUMMARY

1. The probability of increased numbers of sporadic cases of leprosy in the temperate zones following the mass migrations of troops and

families through endemic areas has been pointed out. The symptoms and signs of the disease may well place it within the scope of the orthopedic clinic.

2. A brief review of the literature on transmission, pathogenesis, pathology, clinical classification, roentgenological findings, diagnosis, treatment, and prognosis has been presented.

3. A working knowledge of the disease has been summarized for the orthopedist so that his index of suspicion will cause him to think of leprosy when confronted with a case.

REFERENCES

1. **ARNOLD, H. L., Jr.:** Differentiation of lepromatous from "neural" leprosy; basis, method, and report of 5 cases. *Arch. Dermat. & Syph.* **52:** 354-364, Nov.-Dec. 1945.
2. **AYCOCK, W. L., and GORDON, J. E.:** Leprosy in veterans of American wars. *Am. J. M. Sc.*, **214:** 329, Sept. 1947.
3. **CHAMBERLAIN, W. E.; WAYSON, N. E.; and GARLAND, L. H.:** Bone and joint changes of leprosy; roentgenologic study. *Radiology* **17:** 930-939, Nov. 1931.
4. **COONEY, J. P., and CROSBY, E. H.:** Absorptive bone changes in leprosy. *Radiology* **42:** 14-19, Jan. 1944.
5. **FAGET, G. H., and MAYORAL, A.:** Bone changes in leprosy; clinical and roentgenologic study of 505 cases. *Radiology* **42:** 1-13, Jan. 1944.
6. **FAGET, G. H.; ERICKSON, P. T.; and Sister HILARY ROSS:** Sulfone therapy for leprosy. *Modern Medicine* **25:** Oct. 1947.
7. **FAGET, G. H., and ERICKSON, P. T.:** Chemotherapy of leprosy. *J.A.M.A.* **136:** 451-457, Feb. 14, 1948.
8. **FITE, G. L.; CAMBRE, J. J.; and TURNER, M. H.:** Procedure for demonstrating lepra bacilli in paraffin sections. *Arch. Path.*, **43:** 624-625, June 1947.
9. **HAYATA, HIROSHI:** Transmission and Course of Leprosy. Unpublished Notes. Airaknen Yagaji Island, Okinawa, 1945.
10. **HOPKINS, R.:** Bone changes in leprosy. *Radiology* **11:** 470-473, Dec. 1928.
11. **MUÑOZ RIVAS, G.:** El Hemocultivo en la Lepra, Nov. 1945. Editorial Cromos, Bogota, Columbia, S. A.
12. **MUÑOZ RIVAS, G.:** Longevidad de un Bacilo Acido Alcohol Resistente. Comunicación al la Academia de Ciencias Exactas, Físico—Químicas y Naturales, Nov. 1947, Bogota, Colombia, S. A. Editorial Cromos, Bogota.
13. **MUÑOZ RIVAS, G.:** Pulgas, Suelos y Lepra. Primer Congreso Inter-Americano de Medicina, 7-15 Sept. 1946, Rio de Janeiro, Brazil. Editorial Cromos, Bogota, 1946.
14. **MURDOCK, J. R., and HUTTER, H. J.:** Leprosy; roentgenological survey. *Am. J. Roentgenol.* **28:** 598-621, Nov. 1932.
15. **OBERDOERFFER, M. J., and COLLIER, O. R.:** Roentgenological observations in leprosy. *Am. J. Roentgenol.* **44:** 386-395, Sept. 1940.
16. **PORRITT, R. J., and OLSEN, R. E.:** Two simultaneous cases of leprosy developing in tattoos. *Am. J. Path.* **23:** 805, Sept. 1947.
17. **SLOAN, N. R.:** Early diagnosis of leprosy as seen in Hawaii. *Hawaii M. J.* **3:** 111-120, Jan.-Feb. 1944.
18. **SLOAN, N. R.:** Tracheotomy in leprosy. *Internat. J. Leprosy* **12:** 11-30, 1944.

19. SLOAN, N. R.: Promin and other sulfones in leprosy: preliminary report
Hawaii M. J. 7: 19-22, Sept.-Oct. 1947.
-

ACKNOWLEDGMENT.—The author gratefully acknowledges the criticism of Dr. Norman R. Sloan, of Kalaupapa Settlement, Molokai, T. H., and his courtesy in supplying roentgenograms for illustrations. The clinical illustrations are published by the courtesy of Dr. John R. Walker. Figure 12 is published by courtesy of the Department of Orthopedic Surgery, State University of Iowa, Service of Dr. Arthur Steindler.



THE USE OF CURARE IN ANESTHESIA IN A UNITED STATES NAVAL HOSPITAL

CHARLES W. REYNOLDS
Lieutenant (MC) U. S. N.

CURARE is the generic name applied to a number of plants indigenous to South America which have been known by the natives of that country to have paralytic effects on the human body. For this reason extracts of these plants were employed for centuries as arrowhead poisons. The physiological properties of these plants have been studied for over a century, but their clinical application has been retarded by the uncertain origin and varying potency of different species. During the last 15 years more extensive study and research has yielded a product sufficiently well standardized and uniform in its physiological action to be of real clinical value. No attempt will be made here to review the history of the clinical development of curare products, but a few points of fundamental nature as applied to the use of curare as a supplementary agent in anesthesia are discussed, and a brief analysis of a series of 130 operations in which curare was used at the U. S. Naval Hospital, San Diego, Calif., during a 10-month period is presented.

The difficult task of isolating the active principal or principals from the many plants known to have curariform properties was accomplished by H. King in 1935. He announced the isolation of a highly active quaternary base chloride, designated by him, *d*-tubocurarine chloride, from a species of bamboo tube curare. An extract from a single plant, *Chondodendron tomentosum*, has since been prepared and found sufficiently uniform in strength for clinical use. In terms of physiological activity the extracts from this plant contain about 40 percent of the alkaloid *d*-tubocurarine chloride. Preparations of the pure alkaloid are also available commercially. The preparation referred to in this article whenever the general term "curare" is employed, is prepared commercially and is marketed under the trade name "Intocostin." It is an extract prepared from *Chondodendron tomentosum* and contains the equivalent of 20 units of standard curare per cubic centimeter. A unit is equivalent to 1 mg. of an arbitrary

curare sample used as a standard. The potency of *d*-tubocurarine chloride as determined by bio-assay is 6.5 units per mg. The method of bio-assay is based on an observation of the weakening effect of curare on the neck muscles of the rabbit.

MECHANISM OF ACTION OF CURARE

The mechanism of action of curare is believed to be that of elevating the threshold of excitability of muscle fibers, or the "receptive substance," to acetylcholine stimulation. Blood cholinesterase has been found to be suppressed by curare, which dispels the theory that curare action is due to fermentative decomposition of acetylcholine by an increase in blood cholinesterase. This action of curare appears to be a selective one, and applies only to striated muscle, in doses used clinically. Perhaps in large doses a similar mechanism affecting autonomic nerve transmission exists as well. Luco and Mesa (25) in 1941 confirmed earlier experiments by Langley and Anderson that curare, besides blocking neuromuscular synapses, interrupts transmission in autonomic ganglia. This autonomic blocking effect has not been observed clinically, as evidenced by the absence of any demonstrable effect on glands or smooth muscle. According to the theory of the humoral transmission of nerve impulses, acetylcholine is the chemical mediator responsible for the propagation of nerve impulses from nerve fibers to the "receptive substance" of the individual tissue cells. This was first demonstrated in the transmission of autonomic nerve impulses by the classical experiment of Loewi in 1926. Later experiments identified acetylcholine as the chemical mediator in somatic nerve transmission as well. Whatever the exact mechanism, the result of the intravenous administration of curare to man is a selective paralysis of striated muscles without evidence of the interruption of nerve transmission to structures innervated by the autonomic nervous system. This paralytic action on the skeletal musculature follows a fairly uniform pattern, affecting in succession the muscles of the head and neck, extremities, abdominal wall, intercostal muscles and lastly the diaphragm. In proper doses paralysis of the muscles of the head, neck, trunk, and extremities can be produced without affecting the diaphragm. It is apparent, however, that with increasing doses respiration will become impaired as the muscles of the thoracic cage and abdominal wall are paralyzed. The so-called "lissive" effect of curare is a reversible phenomenon and involves no structural change in either nerve or muscle fibers. The onset of the curare effect in man is quite rapid, usually within 5 minutes, following intravenous injection. The effect is maximal in about 10 or 15 minutes and gradually subsides thereafter until at the end of 45 minutes the effect of a single

dose is almost completely lost. As curarization is carried out over several hours, relaxation can be observed to occur with successively smaller doses, suggesting a slight cumulative effect. The drug is believed to be detoxified by the liver and excreted by the kidneys.

Curare, per se, is not an anesthetic agent, as it has no direct action on nerve tissue. Its employment in anesthesia is solely for the purpose of producing muscular relaxation. Smith, et al., in the human subject, conclusively demonstrated a completely intact sensorium in doses of curare sufficient to produce complete motor paralysis of skeletal muscles and the diaphragm. This study was most enlightening since previous experiments, mostly on animals, suggested some central nervous system effect. A trained observer, a member of the anesthesia staff, was selected as the subject for this study. By prearranged signals, response to questions throughout the experiment was possible. With complete muscular and diaphragmatic paralysis, respirations being maintained by manual inflation of the lungs employing a pharyngeal airway, face mask, and anesthesia machine to deliver oxygen, the subject was acutely aware of the environment and upon recovery from the curare effect was able to recall the conversation which took place during the experiment. Painful stimuli were appreciated throughout. Electroencephalogram and electrocardiogram tracings, as well as blood pressure and pulse rate were recorded continuously. These were all essentially unchanged throughout the period of curarization.

REACTION

No clinical evidence has presented itself of any toxic effect on the heart, liver, kidney, or gastro-intestinal tract. Electrocardiogram studies by various investigators fail to reveal any effect of the drug on the conduction system of the heart. The blocking of vagal impulses observed in animals has not been observed in man. The danger in the administration of curare is the possibility of producing complete paralysis of the accessory muscles of respiration and the diaphragm with attending tissue anoxia. Most of the toxic effects attributed to curare are directly or indirectly associated with its depressing effect on respiration.

USE IN ANESTHESIA

Various techniques in the use of curare have evolved from its clinical application in anesthesia during the last 6 years. Many anesthesiologists use it in minimal doses to potentiate the relaxing effect of cyclopropane and ether. Others use much larger doses to the point of producing respiratory arrest, and rely upon manually controlled respiration to maintain gaseous exchange. Its use is adaptable to almost any combination of anesthetic agents employed in general anesthesia. The

greatest virtue of curare is its ability to produce a very profound state of muscular relaxation in a light plane of anesthesia. Curare offers a means of approaching the ideal condition of providing optimal operative conditions in a plane of anesthesia which is relatively innocuous to the patient. The operative survival rate of old, debilitated, or poor risk patients may thus be higher. Likewise the patient suffering from shock, dehydration, or hemorrhage on whom an emergency operation is deemed necessary would have a better chance of survival than if other methods of general anesthesia employing a deeper plane of anesthesia were used.

TABLE 1.—*Operations in which curare was used throughout the operative period to obtain muscular relaxation*

<i>Operation performed</i>	<i>Number of cases</i>
Gastric resection, partial-----	18
Cholecystectomy-----	19
Exploratory laparotomy-----	12
Pancreatitis, acute-----	1
Tumor with abdominal metastases-----	4
Abdominal adhesions-----	3
Stab wound, abdomen-----	2
Cholecystectomy, partial hepatectomy, and cecostomy-----	1
Excision of tumor or cecum and appendectomy-----	1
Suturing, perforated peptic ulcer-----	3
Salpingectomy (ruptured tubal pregnancy)-----	4
Appendectomy-----	3
Hysterectomy, total-----	3
Splenectomy (ruptured spleen)-----	2
Vagotomy-----	2
Vagotomy and repair of diaphragmatic hernia-----	1
Vagotomy and gastrojejunostomy-----	1
Repair, ventral hernia-----	2
Ureterolithotomy-----	1
Nephrectomy-----	1
Salpingectomy and oophorectomy (chronic P. I. D.)-----	1
Oophorectomy and appendectomy-----	1
Colectomy (transverse colon)-----	1
Abdomino-perineal resection-----	2
Gastro-enterostomy-----	1
Colostomy-----	1
Repair, inguinal hernia-----	1
Repair, traumatic vesicovaginal fistula-----	1
Cystectomy and ureterosigmoidostomy-----	1
Cholecystojejunostomy (first stage Whipple operation)-----	1
Pancreatectomy and duodenectomy (second stage Whipple operation)-----	1
Total-----	84

TABLE 2.—Operations in which curare was used only to facilitate intratracheal intubation

<i>Operation performed</i>	<i>Number of cases</i>
Thoracotomy.....	6
Excision, lower esophagus and cardia of stomach.....	1
Arthroplasty of shoulder, Bankhart type.....	4
Nephrectomy.....	3
Thyroidectomy.....	2
Spinal fusion.....	2
Mastectomy, radical.....	2
Sympathectomy, Smithwick type.....	2
Sympathectomy, high dorsal, unilateral (angina pectoris).....	1
Plastic repair of mandible.....	1
Excision, maxillary cyst.....	1
Excision, branchial cleft cyst.....	1
Open reduction of radius and ulna.....	1
Craniotomy (depressed skull fracture).....	1
Ureterolithotomy.....	1
Total.....	29

TABLE 3.—Operations in which curare was used to supplement spinal anesthesia

<i>Operation performed</i>	<i>Number of cases</i>
Hysterectomy, total.....	3
Hysterectomy, subtotal.....	1
Cesarean section.....	3
Vagotomy.....	1
Gastrectomy.....	1
Total.....	9

In addition to the operations listed in tables 1, 2, and 3, curare was used in 6 bronchoscopies and 2 esophagoscopies.

In the earlier cases of this series being reported, curare was employed as an adjunct to cyclopropane anesthesia to enhance the relaxation normally afforded by this gas. Intubation was accomplished after the patient was anesthetized to a moderately deep plane of anesthesia (plane 2 or plane 3 of the third stage). The anesthesia was then lightened and maintained at about the upper second plane and curare administered as needed to provide additional relaxation. Later in this series, curare was used to facilitate intubation, a light plane of anesthesia was maintained throughout, and curare used in somewhat larger doses. Table 1 is presented to show the type cases in which curare was employed throughout the operation to provide maximal muscular relaxation. Table 2 is presented to show illustrative cases in which curare was employed only as a means of facilitating intubation. Table 3 represents operations in which curare was employed to supplement spinal anesthesia. The writer has used curare in the following type operations or conditions:

(a) Major operative procedures, particularly in upper abdominal surgery, in which profound relaxation is needed. These include gastric resections, cholecystectomies, splenectomies, colectomies, etc.

(b) Routinely in some other general anesthetics for the sole purpose of facilitating intratracheal intubation.

(c) As an aid in bronchoscopy and esophagoscopy.

(d) As a supplement to a light general anesthetic employed when spinal anesthesia is wearing off in a long operation.

(e) To relieve hiccoughs occurring in the course of a general anesthetic.

PRECAUTIONS

Many precautions in the use of curare must be taken. Complete equipment for the ready passage of an intratracheal tube must be at hand. For those not accustomed to using the intratracheal method of administering general anesthetics, curare had better not be used. It is my practice to routinely employ this method whenever the use of curare is planned. This obviates the danger of obstruction of the air passages from the relaxing effect of curare on the jaw and pharynx, and offers an unobstructed airway for maintaining artificial respiration if curare produces too profound an effect on the respiratory muscles. In addition, intratracheal anesthesia favors good relaxation by the quiet, effortless breathing which occurs with its use. Physostigmine, prostigmine, or neostigmine, the physiological antagonists of curare, should be at hand to annul the effects of curare if they persist beyond the operative period. Suction apparatus for aspiration of tracheobronchial secretions must be at hand and used as indicated. Patients known to have or suspected of having myasthenia gravis should not be given curare, inasmuch as this condition itself is believed to be due to the inability of the muscle "receptive substance" to respond to acetylcholine stimulation.

PREOPERATIVE MEDICATION

Preoperative medication when curare is used does not differ from that which is ordinarily employed in general anesthesia. If nitrous oxide and oxygen are to be relied upon as the sole agents for maintenance after intubation, premedication should be heavy in the average case, or additional fractional doses of morphine intravenously used during the course of the anesthetic. If cyclopropane or ether are to be used, somewhat smaller doses of premedicating drugs are employed. Every patient going to surgery should be seen by the anesthesiologist the day before surgery, and an estimate of the metabolic activity, reflex excitability, and other factors made. For the

average case, morphine sulfate $\frac{1}{8}$ to $\frac{1}{4}$ grain, and scopolamine $\frac{1}{150}$ to $\frac{1}{100}$ grain are given subcutaneously about 1 hour preoperatively. Pentobarbital (nembutal) may be given in $1\frac{1}{2}$ grain doses the night before surgery and again 1 hour preoperatively. If it is inconvenient to give the morphine and scopolamine at the prescribed time, it may be well to wait until the patient is brought to the operating or anesthesia room and the preoperative medication given intravenously, slowly (over 2 or 3 minutes time). The patient is then observed for a period of 10 or 15 minutes to determine the degree of narcosis and the amount of respiratory depression obtained. The maximal effect of morphine, when given intravenously, is evident within this period of time. An estimate of the amount of anesthetic needed for that particular patient may be made. Morphine should be given with extreme caution in the aged and in children because of the profound respiratory depression which may occur. Senile patients are preferably given demerol (50 to 100 mg.) in place of morphine. It has not been the writer's practice to give morphine to children under the age of 8 years. Seconal $\frac{3}{4}$ grain, per rectum or orally, provides the average child between the age of 2 and 7 years adequate sedation. Scopolamine or atropine should always be given in appropriate doses to minimize salivation and tracheobronchial secretion, and to counteract or inhibit certain reflex vagal stimulation which may occur from various causes during the operation.

METHOD

The technique which has proved best in the hands of this writer for most major surgical procedures follows. The patient's throat is anesthetized by the topical application of a local anesthetic agent, preferably 2-percent pontocaine hydrochloride solution, by means of an atomizer or laryngeal forceps a few minutes before the anesthetic is started. This minimizes the danger of laryngospasm during induction and annuls the stimulating effect of the intratracheal tube upon passage through the glottis. Anesthesia is induced by the slow intravenous administration of a $2\frac{1}{2}$ -percent solution of pentothal sodium to the point at which the lid reflex is absent. Forty or sixty units of Intocostin (2 or 3 cc.) is then injected intravenously. The patient is kept asleep by the intermittent injection of a few cubic centimeters of pentothal until the effect of the curare in producing relaxation of the jaw is evident. This usually occurs within 5 minutes. An assistant begins the administration of oxygen as soon as consciousness is lost, using a semiclosed system and allowing the expired carbon dioxide to accumulate in the rebreathing bag to favor deep breathing. Intubation is accomplished by the oral route under direct vision using the Lundy or Guedel laryngoscope, and as large an intra-

tracheal tube as will pass between the vocal cords without forcing. The tube is then secured by a piece of adhesive tape to the patient's face, and attached to the anesthesia machine by suitable connectors for closed system anesthesia. The mouth is carefully packed with a moist, fine-meshed, gauze pack to aid in the absorption of secretions and to hinder the escape of the anesthetic gases which may leak around the intratracheal tube. Usually not more than 500 mg. (20 cc.) of pentothal, 2½-percent, is required to induce and maintain anesthesia until the passage of the intratracheal tube is accomplished. If the patient is too light upon first attempting intubation, as evidenced by swallowing or phonation, more pentothal and curare solution are injected and the oxygen mask is reapplied for a few more minutes. The process of inserting the intratracheal tube should not require more than 1 minute, and if difficulty is encountered it is better to abandon further attempts until the patient is more relaxed and inflation of the lungs with oxygen is accomplished.

Anesthesia is maintained in the first or second plane of the third stage of anesthesia throughout the operation, employing a mixture of 75 percent nitrous oxide and 25 percent oxygen, and whatever additional amounts of pentothal as may be needed to maintain the desired depth of anesthesia. A plane of anesthesia sufficient to prevent the patient from straining on the intratracheal tube is sufficient. Adequate anesthesia cannot be maintained on some patients with this combination of agents unless an excessive amount of pentothal is used. In this case the addition of a small amount of cyclopropane or ether may be needed. If there is any suggestion of cyanosis, in the presence of adequate expansions of the lungs, the percentage of nitrous oxide is reduced and other agents added. Intocostrin in fractional doses is injected to maintain the desired amount of muscular relaxation. Forty or 60 units is usually given after the passage of the intratracheal tube to minimize straining. The next injection of curare is made at the time of the skin incision and subsequent doses as needed. Usually a total of 100 to 140 units is necessary to obtain sufficient relaxation for opening of the peritoneal cavity. Once adequate relaxation is obtained, the addition of 20 to 40 units every 30 to 45 minutes is enough to keep the patient relaxed. If ether is being employed, smaller doses of curare should be used, inasmuch as ether itself possesses curariform properties.

Recovery from the anesthetic is usually rapid since a light plane of anesthesia with gases which are quickly expelled from the lungs and an intravenous agent (pentothal) of short duration are employed. Emergence excitement is rare. If a profound state of curarization, as evidenced by the absence or impairment of costal breathing, persists beyond the operative period, manual inflation of the lungs should

continue until normal spontaneous breathing occurs. This may necessitate the intravenous injection of 1 or 2 cc. prostigmine methylsulfate 1:2000 to counteract the curare effect. Normal respirations usually occur within 30 minutes of the last dose of curare, unless an exceptionally large amount has been used over a long period. Prostigmine is not used unless deemed essential, because the increased salivation and increased tracheobronchial secretions produced by this drug may be a source of annoyance and cause some obstruction. The intratracheal tube in all cases is left in place until expulsive efforts occur. Thorough aspiration of tracheal secretions is carried out just prior to removal of the tube. The patient is observed closely for 5 or 10 minutes after the tube is removed, and before returning to the ward, to make sure that respirations, skin color, blood pressure, and pulse are satisfactory.

In the procedure outlined above, nitrous oxide and oxygen are relied upon to provide most of the anesthesia. Frequently this is all that is needed to maintain anesthesia in the lower first plane of anesthesia, especially with the basal narcosis provided by the initial dose of pentothal. Additional small amounts of pentothal are added only if the patient begins to strain or move. Sometimes a wrinkling of the eyebrows is observed if the patient is too light. Morphine sulfate $\frac{1}{8}$ to $\frac{1}{6}$ grain may be given intravenously at this point if adequate narcosis is difficult to attain. The addition of a small amount of cyclopropane or ether to the gas mixture may provide the additional amount of anesthesia needed. The particular anesthetic agent or combination of anesthetic agents used is not of prime importance, providing a light plane of anesthesia with adequate oxygen supply is obtained. Nitrous oxide, because of its absence of toxic effects, and its rapid elimination without unfavorable or unpleasant postanesthetic sequelae is probably the anesthetic agent of choice in this method. An adequate oxygen supply is imperative, and concentrations of nitrous oxide in excess of 75 percent are not recommended. It is my practice to maintain a flow of 3 liters of nitrous oxide and 1 liter of oxygen per minute, allowing the excess gas to escape through the overflow valve. The signs of anesthesia as outlined by Guedel often are not applicable when curare is used in adequate doses. By using the more potent anesthetic agents such as cyclopropane and ether, a deeper plane of anesthesia than is needed may be attained. If this situation obtains, the prime purpose for which curare is employed is thereby defeated. If the anesthetic is properly conducted the patient should respond within a few minutes after the operation, even when anesthesia has been maintained for 3 or 4 hours. This is manifested by swallowing or straining on the intratracheal tube. Frequently the patient is awake and responding to commands before leaving the operating room.

ADVANTAGES

The absence of unfavorable anesthetic sequelae constitutes one of the greatest merits of this type of anesthetic. The patients do not require the close attention necessary as when a prolonged postanesthetic depression from a deep plane of anesthesia occurs. Nausea, emesis, abdominal distension, and other gastro-intestinal complaints that can be attributed to other anesthetic procedures rarely occur. Emergence excitement, if it occurs, is the exception. The profound metabolic changes often associated with a prolonged ether anesthesia, such as dehydration, acidosis, hemoconcentration, etc., are avoided.

The advantages of this method of anesthesia for major surgery may be summarized as: (*a*) A smooth, pleasant, rapid induction with the absence of struggling, and the maintenance of a high alveolar oxygen concentration by the simultaneous administration of oxygen; (*b*) easy passage of the intratracheal tube because of the good relaxation of the jaw and pharyngeal muscles, and the absence of excessive salivation; (*c*) maintenance of anesthesia in a light plane, thereby minimizing the shocking effect of the anesthetic itself; (*d*) complete muscular relaxation and quiet respirations are obtained; (*e*) an early emergence from the anesthetic, thereby avoiding the depressing effect of an anesthetic that persists for several hours beyond the operative period; and (*f*) elimination of the explosion hazard by the use of nonexplosive anesthetic agents. Many advantages attributed to intratracheal anesthesia itself include the maintenance of a good airway which permits aspiration of accumulating tracheobronchial secretions, a means of controlling the degree of expansion of the lungs, a ready means of artificial respiration in the event of respiratory arrest, quiet breathing which minimizes the effort expended by the patient in breathing, and the avoidance of straining, excessive diaphragmatic breathing and other conditions unfavorable to the surgeon as well as the patient.

Baird (3), at the University of Minnesota, has reported an analysis of 160 cases employing a mixture of *d*-tubocurarine chloride and pentothal solution (2½ percent), together with inhalation of a 50-50 mixture of nitrous oxide and oxygen. After considerable trial with mixtures of pentothal and curare preparations, he found that a mixture containing 5 units of *d*-tubocurarine chloride and 25 mg. of pentothal per cc. formed a stable solution without precipitating, and offered as nearly as possible the proper proportions of both agents to produce adequate anesthesia and maximal relaxation for major surgery. The nitrous-oxide-oxygen mixture provided additional anesthesia and an adequate oxygen supply. Intubation was performed routinely. Preoperative application of a local anesthetic agent to the throat was not done. In his series laryngospasm was reported as minimal and bronchospasm either absent or unrecognized. Induction prior to in-

tubation was usually accomplished with 15 to 20 cc. of the mixture (75 to 100 units of *d*-tubocurarine). The method employed, aside from using a mixture of pentothal and curare instead of injecting the agents separately, is similar to that used in this report. Intocostarin, unless properly buffered and in the proper concentration, will form a heavy precipitate with sodium pentothal because of the difference in *pH* of the two solutions. It is the writer's impression that the topical application of pontocaine solution to the throat immediately prior to induction is of great benefit in further minimizing the incidence of laryngospasm. Difficulty in passing the intratracheal tube, due to adduction or overactivity of the vocal cords was noted only in the occasional case in which this procedure was not followed.

Cullen et al., at the University of Iowa, report the use of pentobarbital sodium (nembutal) and curare induction for endotracheal intubation. Pentobarbital sodium in 5 or 6 percent solution and curare (Intocostarin) were injected intravenously, separately, and in fractional doses until a light plane of anesthesia and a relaxed jaw were obtained. Intubation was accomplished in the usual manner, and anesthesia maintained with a mixture of nitrous oxide 70 to 80 percent and oxygen 20 to 30 percent using the to-and-fro absorption method. Curare was then added as needed to obtain the desired relaxation. They felt that the employment of a nonsulfurated barbiturate (nembutal), in preference to pentothal, minimized even further the danger of laryngospasm. Curare is believed in itself to prevent or overcome laryngospasm due to the relaxing effect on the muscles of the vocal cords. Many times when the cords are not abducted, the intratracheal tube will readily pass between the cords with a very slight pressure.

The use of curare and a light plane of pentothal anesthesia makes possible bronchoscopy for some patients on whom the passage of a bronchoscope under local anesthesia alone is extremely difficult or impossible. Very apprehensive or uncooperative patients, those with very active laryngeal reflexes, or those presenting some anatomical feature such as a short neck, receding jaw, large epiglottis which makes visualization of the glottis difficult can better be bronchoscoped by this method. It should be emphasized that too much dependence should not be placed on the pentothal for anesthesia, but a thorough application of a topical anesthetic agent should be employed the same as though this were the sole method of anesthesia employed. Oxygen should be passed through the bronchoscope during this procedure. Just enough curare, 40 to 60 units of Intocostarin, to produce relaxation of the jaw is employed. The amount of pentothal required is not excessive if proper premedication and adequate topical anesthesia if the throat is employed. Because of the relatively rapid induc-

tion of anesthesia, the patient should be observed closely at the end of the bronchoscopy for signs of obstruction or respiratory depression. The use of curare and pentothal in conjunction with suspension laryngoscopy with the Lynch apparatus has been reported.

Frequently in an operation performed under spinal anesthesia, when the operation outlasts the spinal effect, pentothal or gas may be started to tide the patient over for the remainder of the operation. The amount of supplementary anesthesia needed is often more than was at first deemed necessary. Relaxation is often inadequate to permit closure. At the first indication that the anesthetic is wearing off, intravenous pentothal, together with a mixture of nitrous oxide and oxygen by inhalation, may be started, and enough curare added to provide the needed relaxation. In this series, curare was used 14 times to supplement spinal anesthesia. The author has found it useful for closure in cesarean sections, in which a low dose, low level anesthesia was used. The use of a long-acting (pontocaine) for spinal anesthesia, supplemented if needed by the above method, has largely eliminated the need for continuous spinal anesthesia.

Hiccoughs are frequently a source of annoyance to the surgeon and anesthetist, particularly in upper abdominal surgery. Traction on, or manipulation of viscera lying close to the diaphragm frequently induce this. Sometimes deepening the anesthetic may abolish the hiccoughs, but this is often slow, difficult to attain, or ill-advised on the basis of the patient's general condition. The use of carbon dioxide, either by direct flow or by "cutting out" the soda lime absorber for a while, may overcome the hiccoughs by the hyperpnea which ensues. Here again the results are slow and uncertain. Curare in fractional doses will usually abolish it in a short time. It may be necessary to give curare in large doses to the point of near respiratory arrest and maintain controlled respiration for a while to get the desired result. In this series, curare was used successfully for this purpose in seven cases. None of the cases upon which this method was attempted, failed to be relieved of the hiccoughs within 15 minutes.

Several authors have reported the appearance of hypotension and bronchospasm occurring soon after the administration of curare. This unfavorable reaction occurred in patients receiving large initial doses. In addition to the hypotension, the patients appeared cyanotic in spite of a high flow of oxygen, and a resistance to manual compression of the rebreathing bag in the closed anesthetic system. It has been suggested, and supported by considerable amount of experimental evidence, that this is due to the mobilization of histamine from the tissues of certain susceptible individuals. Experiments with spinal animals in the conscious state showed this reaction to occur almost uniformly. The intracutaneous and intra-arterial injection of curare extracts in man

regularly produced a histamine-like wheal with pseudopods. This was also observed with the pure *d*-tubocurarine chloride. The reason this does not occur more frequently in anesthesia with curare is probably due to the fact that anesthetic agents themselves suppress histamine production. Nevertheless it may occur and one should be alert to this possible unfavorable reaction. I have observed two cases in which this response to curare was suspected. In one of these cases the intravenous administration of 15 grains of aminophylline over a period of 5 minutes relieved the apparent bronchospasm. Some authors recommend the prophylactic administration of antihistamine drugs such as pyribenzamine or benadryl preoperatively in cases where curare is employed.

As curare continues to be used in anesthesia, many changes in techniques and indications for its use will occur. Curare is still pretty much in its infancy as a clinical agent. As with many other drugs, the early enthusiasm with which it is received by the medical profession may be dampened as unfavorable effects of the drug appear. In the light of the present knowledge of this drug, there is promise of even greater and more diverse uses in anesthesia as well as in other branches of medicine.

One should not gain the impression that an attempt is being made here to replace other methods of anesthesia by using curare. Ether retains its seat of honor among the anesthetic agents which have stood the test of time. Spinal anesthesia remains the anesthetic of choice for most lower abdominal operations, pelvic surgery, operations on the perineum and rectum, and lower extremity surgery. This is particularly applicable to military medicine in which the average patient is a good surgical risk. The technique of spinal anesthesia is relatively simple and well standardized, and the amount of equipment necessary is minimal. This series of 130 anesthetics employing curare represents but a small fraction of the total number of anesthetics of all types used at this hospital. Emphasis on the use of curare, however, is made because it offers a technique particularly applicable to the below-average or poor risk patient, and because it is such a useful adjunct to other anesthetic agents.

SUMMARY

1. A brief survey of the standardization of curare is presented.
2. The mechanism of action and physiological properties of curare are discussed.
3. Five specific types of operative cases or conditions in which curare can be advantageously employed are presented, and a technique for its use in a major operation is offered. Tables 1, 2, and 3 are compiled from a series of 130 operations in which curare has been used

at this hospital during the last 10 months. Table 1 shows the particular operations in which curare was used to produce relaxation of the abdominal wall throughout most of the operation. Table 2 shows representative operations performed under intratracheal anesthesia in which curare was employed only as an aid for intratracheal intubation. Table 3 shows the operations in which it has been used as a supplement to spinal anesthesia.

4. Some of the advantages offered by intratracheal anesthesia with curare as an adjunct are discussed, together with a discussion of the precautions necessary and unfavorable reactions which may occur in this method of anesthesia.

REFERENCES

1. ADAMS, R. C.: Curare as aid to relaxation in anesthesia. *S. Clin. North America*. 25: 735-739, Aug. 1945.
2. BAIRD, J. W.: Pentothal-curare mixture. *Anesthesiology* 8: 75-79, Jan. 1947.
3. BAIRD, J. W.; JOHNSON, W. R.; and VAN BERGER, M. D.: Pentothal-curare solution; a preliminary report and analysis of its use in 160 cases. *Anesthesiology* 9: March 1948.
4. BODDY, J.: Use of curare in sodium pentothal-nitrous oxide-oxygen anesthesia. *Anesthesiology* 6: 381-384, July 1945.
5. CARLL, F. W.; DEEVER, J. M.; and PHILLIPS, R. B.: Norfolk explosion disaster, U. S. Nav. M. Bull. 42: 284-292, Feb. 1944.
6. CARRON, H.; STOELTING, V. K.; and CULLEN, S. C.: Pentobarbital sodium-curare induction for endotracheal intubation. *Anesthesiology* 9: 11, Jan. 1948.
7. COLE, F.: Use of curare in anesthesia; review of 100 cases. *Anesthesiology* 6: 48-56, Jan. 1945.
8. COMROE, J. H., JR., and DRIPPS, R. D.: Histamine-like action of curare and *d*-tubocurarine injected intracutaneously and intra-arterially in man. *Anesthesiology* 7: 260-262, May 1946.
9. COMROE, J. H., JR., and DRIPPS, R. D.: Curare and curare-like compounds. *S. Clinics North America*. 27: 1575, Dec. 1947.
10. CULLEN, S. C.: Clinical and laboratory observations on use of curare during inhalation anesthesia. *Anesthesiology* 5: 166-173, Mar. 1944.
11. CULLEN, S. C.; TRAPASSO, A. J.: Use of curare to facilitate endoscopy; preliminary report. *Arch. Otolaryng.* 38: 347-349, Oct. 1943.
12. CULLEN, S. C.: Use of curare for improvement of abdominal relaxation during inhalation anesthesia; report on 131 cases. *Surgery* 14: 261-266, Aug. 1943.
13. CULLEN, S. C.: Use of curare in anesthesia. *South M. J.* 38: 144-148, Feb. 1945.
14. FEGLER, J., and KOWARZYK, H.: Note sur l'antagonisme reciproque entre la physostigmine et le curare. *Compt. rend. Soc. de biol.* 127: 1149-1152, 1938. (Translation of.)
15. GOODMAN, L., and GILMAN, A.: *Pharmacological Basis of Therapeutics*. 1st edition, revised. The Macmillan Company, New York, 1944.
16. GRIFFITH, H. R., and JOHNSON, G. E.: Use of curare in general anesthesia. 3: 418-420, July 1942.
17. GRIFFITH, H. R.: Curare in anesthesia. *J.A.M.A.* 127: 642-644, Mar. 17, 1945.

18. GROSS, E. G., and CULLEN, S. C.: Action of curare on smooth muscle of small intestine and on blood pressure. *Anesthesiology* 6: 231-238, May 1945.
19. GROSS, E. G., and CULLEN, S. C.: Effects of anesthetic agents on muscular contractions. *J. Pharmacol. & Exper. Therap.* 78: 358-365, Aug. 1943.
20. HARRIS, M. M., and HARRIS, R. S.: Effect in vitro of curare alkaloids and crude curare preparations on "true" and pseudocholinesterase activity. *Proc. Soc. Exper. Biol. & Med.* 56: 223-225, June 1944.
21. HARROUN, P.; BECKERT, F. E.; and HATHAWAY, H. R.: Curare and nitrous oxide anesthesia for lengthy operations. *Anesthesiology* 8: 177, Jan. 1946.
22. KNIGHT, R. T., and BAIRD, J. W.: Anesthesia for the aging and aged. *Journal-Lancet* 64: 183-185, June 1944.
23. KNIGHT, R. T.: Use of curare in anesthesia. *Minnesota Med.* 27: 667-670, Aug. 1944.
24. LANDMESSER, C. M.: Study of bronchoconstrictor and hypotensive actions of curarizing drugs. *Anesthesiology* 8: 506, Sept. 1947.
25. LUÑO, J. V., and MESA, J.: Acción del curare en los sistemas neuroefectores autonómicos. *Ciencia* 2: 298-299, Sept. 25, 1941. (Translation of.)
26. LUNDY, J. S.; TUOHY, E. B.; ADAMS, R. C.; MOUSEL, L. H.; and SELDON, T. H.: Annual Report for 1944 of Section on Anesthesiology, including data and remarks concerning blood transfusion and use of blood substitutes. *Proc. Staff Meet., Mayo Clin.* 20: 292, Aug. 22, 1945; 324, Sept. 5, 1945.
27. ROBBINS, B. H., and LUNDY, J. S.: Curare and curare-like compounds; a review. *Anesthesiology* 9: 349, July 1947.
28. RUSKIN, A.; EWALT, J.; and DECHERD, G. M., JR.: Electrocardiogram of curarized human patients. *Dis. Nerv. System* 4: 335-341, Nov. 1943.
29. SMITH, S. M.; BROWN, H. O.; TOMAN, J. E. P.; and GOODMAN, L. S.: Lack of cerebral effects of *d*-tubocurarine. *Anesthesiology* 8: 1-14, Jan. 1947.
30. SMITH, S. M.: Use of curare in infants and children. *Anesthesiology* 8: 176-180, Mar. 1947.
31. WATERS, R. M.: Nitrous oxide-oxygen and curare. *Anesthesiology* 5: 618-619, Nov. 1944.
32. WEST, R.: Pharmacology and therapeutics of curare and its constituents. *Proc. Roy. Soc. Med.* 28: 565-578, Mar. 1935.
33. WHITACRE, R. J., and FISHER, A. J.: Clinical observations on use of curare in anesthesia. *Anesthesiology* 6: 124-130, Mar. 1945.
34. WINTERSTEINER, O., and DUTCHER, J. D.: Curare alkaloids from *chondodendron tomentosum*. *Science* 97: 467-470, May 21, 1943.



ANALYSIS OF SUBMARINE FOOD PROBLEMS IN WORLD WAR II

CHARLES W. SHILLING

Captain (MC) U. S. N.

and

IVAN F. DUFF

Commander (MC) U. S. N. R.

ORDINARILY physicians are not greatly concerned with the details of food supplies. In the Navy, the Bureau of Supplies and Accounts has cognizance of commissary matters. The naval medical officer, however, “* * * in carrying out his responsibility related to food” is specifically charged with the duty of “inspecting, as to quality, all fresh provisions issued an authorized mess.” It appears that this duty was too often not assumed by medical officers associated with the Submarine Force. In particular, submarine squadron medical officers should actively concern themselves not only with the quality of food issued to submarines but with the planning of menus to provide a dietetically acceptable ration.

It is well known that an adequate and palatable diet is necessary for the smooth functioning of any military organization. Recognition of the many inherent limitations and discomforts of life aboard submarines makes it imperative to exert a special effort to provide a good ration. This is necessary for health, personnel endurance, and morale. In general, the food served aboard submarines in World War II was excellent and well deserved the reputation which it came to have among less elaborately fed branches of the Armed Services.

THE SUBMARINE RATION

The ration provided a submarine needs to fulfill certain requirements. It must have been selected to occupy a minimum of space and evidence excellent keeping qualities under sometimes adverse conditions of stowage. From it a daily well-balanced menu incorporating a maximum of food value, variety, and a minimum of waste should be easily prepared.

Submarines have always had a more generous ration allowance than other ships or stations with a similar complement. At the outbreak of the war the allowance was 85¢ per man per day. As the war progressed

and costs increased, the ration allowance was increased until at the end of the war submarines were allowed \$1.00 per man per day when based in the Continental United States, and \$1.05 in foreign ports.

In addition to more money, submarine commissary officers and commissary stewards have complete freedom in the type and quantity of foods they may draw within the limitations of availability. They may draw fresh or fresh frozen fruits and vegetables as desired. They never have to use "unit loads." The only exception to this freedom is in the case of beef. In most places, throughout the war, submarines were officially required to draw the standard proportions of steaks and roasts (2), stewing beef (1), and ground beef (1).

Planning of menus and of the quantity and distribution of the stores to be carried was the prerogative of the submarine commissary officer and commissary steward either working alone or in conjunction with the tender or base commissary officer. No over-all master menu was developed during the war. However, for 2 or 3 months several of the bases and tenders worked out sample menus which could be used as a guide if the submarine wished.

PATROL INFORMATION

In order to determine accurately the food problems as they existed aboard submarines during World War II, one of us (I. F. D.) has thoroughly studied all the available submarine patrol report comments concerning food and water. There were 1,520 patrols made, of which 1,489 were available for study. The known excellence of the food aboard submarines was undoubtedly the reason that many commanding officers made no mention of it. However, 286 paused in their busy routine to make favorable comments concerning either the food, its preparation, or the cooks and bakers. The adverse or constructive criticisms made by a few of the commanding officers will be more thoroughly studied in the following sections of this article.

STOWAGE SPACE

The amount of space aboard a submarine which may be allotted for food stowage has military significance. For like the fuel, oil, and ammunition capacity, it is definitely one of the factors limiting the length of a submarine patrol. In World War II this was particularly true with reference to the smaller and older "S" class submarines. The amount of food which they could carry to provide a well-balanced menu did not, in general, extend over a 30- to 35-day period. Although these boats made patrols lasting longer than 30 days, the majority of them so doing turned in comments such as follows:

Very little reserve is left in this class of ship after 35 days on patrol. Provisions for all practical purposes are exhausted. The base of the icebox loomed

very large during the last week. No one went hungry, but there was a decided reduction in the quantity and variety of food.

Fleet-type submarines commonly departed on patrol with food supplies calculated to provide them with an endurance of from 70 to 90 days. In the early days of the conflict, especially in the active war zone, it was sometimes difficult to obtain food and supplies. Shortage of provisions occurred on a few occasions giving rise to comments such as these:

Inexperience in planning and procurement for such a long patrol made the diet unsatisfactory. Difficulty in obtaining food at Surabaya prevented getting a full larder. Food had to be rationed.

Food supply was low, the decision to remain on station was based on a 5-day supply of food. The patrol could not have continued for a longer period without a serious reduction in efficiency and health—due to an unbalanced ration.

Occasionally, as the war progressed, deficiencies in the quantity and variety of food sometimes were reflected in a monotonous diet. This was due to different factors—unusually long patrols or unexpected extension of operations, inexperience in loading, poor quality of available food before departure, refrigeration failure, and sometimes accidental flooding of supplies while on patrol. At the end of an 80-day patrol, one of the longest made by any submarine during the war, it was reported:

It was very fortunate that we had taken on a 90-day supply of food (83 men aboard)—by the 77th day choice and variety had disappeared and all food came out of cans. Planning menus was difficult. Five days of provisions were left at the end of the patrol.

Another such long patrol was unexpectedly extended; at the time the ship left her area "food stocks had been reduced to the level that cabbage and asparagus were served for breakfast." On a third patrol, of 60 days' duration, largely due to the inexperience of the commissary officer and the poor quality of food available, "supplies were entirely expended except for two cans of catsup." A fourth submarine after completing an arduous 61-day patrol stated that on about the 30th day, due to the necessity of securing refrigeration during a severe and prolonged depth charging attack, "all fresh meat, vegetables, and fruit had to be surveyed. The diet from then on consisted of canned food. In view of the possibility of refrigeration failure, it is necessary to carry a good reserve of canned food."

Stowage space aboard Fleet-type submarines varies with the make of the boat. Some of the newer ships are provided with double storerooms, others have a single compartment for dry storage with additional locker space in the torpedo rooms. All boats have an icebox and a chill room. Anyone who has ever been aboard a submarine at the time supplies are being loaded has marveled at the ingenuity evidenced by the crew in making stowage space available. Literally, every avail-

able inch of space was used. Iceboxes were crammed, potatoes were stored in hatches, under the deck grating of the cool room; showers were piled high with crates of vegetables and fruit, cases of food were stacked in the pump and engine rooms, in passageways, and pushed under benches. When this space was reduced, individual cans were tucked between the hull and the torpedoes, under bunks, behind manifolds, and in individual personal lockers. It is estimated that an enterprising commissary officer can carry sufficient food, with a complement of 90, to last for from 100 to 150 days, depending on the type of boat. These figures would assume particular importance should occasion ever arise for transporting troops via present-day submarines.

COMMISSARY PERSONNEL

Considerable difficulty was sometimes experienced, and especially at advanced bases, in the satisfactory procurement of food.

In part, as indicated in a number of these reports, poor or unsatisfactory food, while on patrol, was due in some instances to lack of experience of members of the submarine's commissary department.

Food was lacking in variety—a deficiency which probably may be traced to the inexperience of commissary department personnel.

Inexperience in planning and procurement for such a long patrol made the diet unsatisfactory.

Quality of the food was good but ran out of several items due to carelessness in loading.

Provisioning for the next patrol will be undertaken with the assistance of more experienced base or tender personnel.

In loading a submarine with supplies there was and is definite need for skilled assistance from shore-based supply activities. As the veteran commanding officer of one submarine wrote:

Fresh frozen foods and a cream substitute ran out too early on the patrol because of the decision to load the refrigerator with an excessive amount of meat at the expense of other foods. As a result, we arrived in Saipan with a certain amount of meat but low in certain canned foods. There should no longer be any necessity to load to the hilt with the old staples, missing out on taking aboard the more desirable items of food that are available. At any rate, the commissary officer and steward should be furnished a sample list of provisions listing the items—with alternative and quantity—that are recommended to be carried by submarines on war patrols. There has never been anything published to guide the commissary officer to the best of my knowledge although unlimited information must be available. The only system has been the ordering of food carried on previous patrols, which often goes amiss when certain items are not available. It is felt that this haphazard ordering of provisions could be eliminated by preparation of a standard provision list for submarines that would be mandatory on their part to follow. This list could be prepared with alternatives to give it sufficient flexibility to satisfy any boat.

MEAT

The one article of the submarine ration most frequently the subject for comment was meat—as to its quality and quantity. Early in the war, for reasons of space economy, boneless beef was made available to submarines. It came as steaks and roasts, stewing and boiling meat, and chopped beef. Current regulations of the Bureau of Supplies and Accounts concerning the percentage of meat issues for all ships require that 30 percent of the meat be of lesser grade—thus submarines starting on patrol were issued beef in the following proportions: roasts and steaks 50 percent, hamburger 25 percent, stewing and boiling meat 25 percent. This regulation was cause for considerable criticism:

Steaks and roasting beef though a bit tough are satisfactory; stewing and boiling beef is 60 percent waste and, like hamburger, is tough, stringy, and unpalatable.

All of the boned beef taken on this patrol was tough and could have been put to better use in a shoe factory.

When meat loaf is too tough to eat, *that* is a new low.

This is a satisfactory proportion but since stewing and boiling meats are not considered worth the icebox space, it is generally left at the base and other frozen items, as shrimps, frozen foods, and sausage, are taken in quantity to fill the space.

It is understood that commonly submarines draw their inferior meat (and pay for it) and immediately survey it.

One commanding officer recommended that ground beef be removed from the mandatory items for submarines:

There is only one icebox in which must be stored various kinds of food and which must be entered daily on 2- or 3-month patrols. Ground meat absorbs odors quickly and becomes unpalatable after a few weeks at sea. Arrangements should be made so submarines going on war patrols can increase the percentage of roasts and steaks but reduce the percentage of ground meat.

It is pointed out again that more unfavorable comments were made concerning the quality and proportion of issued beef than any other single item on the submarine ration. In view of this, the authors are of the opinion that Bureau of Supply and Accounts regulations should be reviewed with the possibility of making a satisfactory adjustment in the currently allowed percentage of meat issue provided operating submarines. At any rate, the following comments seem reasonable:

At no time should meat of inferior quality be issued submarines for use on war patrols. Various cuts of good meat are recommended.

Limited storage space makes it necessary that every piece of meat be usable in some manner.

ICE CREAM

Ice cream appears to have been the most popular so-called luxury item served on the boats. A few quotations will serve to reenforce this statement:

Once again, (10th patrol of this ship) and despite the cold and bitter weather, ice cream was the most popular dish.

* * * and frequent ice cream was enthusiastically received.

* * * the ice cream machine being very popular with the crew.

The ice cream freezer paid for itself many times over, it being estimated that one ton of ice cream was consumed during the patrol, cold weather notwithstanding.

The ice cream maker turned out a fine produce * * * this device should be placed on all boats.

The ice cream maker continues to be worthy of its weight in gold.

On long hot dives, ice cream is really appreciated and easy to take.

Generally found that near the end of the patrol, ice cream was the food that did not suffer with repetition.

STAPLE ITEMS OF FOOD

Like meat, potatoes are basic in the diet of the average American. It is exceedingly interesting, in view of this fact, that generally speaking but few unfavorable remarks appear in these reports concerning that food article. Most submarines were able to carry a large enough supply of fresh potatoes to last for a variable period well into the patrol. Early in the war a "spud" locker was made out of the trunk of the crew's mess hatch for extra stowage space aboard many boats, augmenting the supply which could be carried by about 50 percent. Widespread alterations to the hatches eventually eliminated this stowage space. To supply potatoes every day for 90 men on a 60-day submarine patrol, approximately 2,800 pounds are required. By ingenious stowage (beneath the deck grating in the cool room, in one of the crew's showers, under mess tables, benches, etc.) it is said that a total of 3,000 pounds can be loaded aboard. Canned, water-packed potatoes were frequently available. Some submarines regarded them superior to regular fresh potatoes, certainly they must have been more convenient to use. Dehydrated potatoes and onions were recommended on long cruises to save space. One pound of dehydrated potatoes makes 10 pounds of mashed potatoes. Two submarines observed:

Rice is an excellent substitute for potatoes and was served frequently.

In the last 2 weeks when potatoes ran out, rice, spaghetti, macaroni, and increased consumption of bread and cake filled our need for starch.

About 2,600 pounds of flour are required for a 70-day patrol. This, which comes in 10-pound cans, was commonly stored in the engine rooms. Some boats had special storage racks in the torpedo rooms

for flour and coffee. It should be pointed out with regard to this staple that bagged flour is unfit for patrol use due to the lack of proper stowage facilities; moreover, "the everpresent danger of oil contamination of flour when kept in other than regular stowage space makes the use of canned flour imperative."

Remarkably enough, considering the universality of drinking coffee in the Navy, coffee was the subject of only two unfavorable comments in all of these reports:

Food was excellent and well prepared with the exception of coffee. Any resemblance between the stuff we have and real coffee is purely coincidental. It was either burned in roasting or was very stale, or both.

The food was generally very good, well prepared, and plentiful, the only exception being the coffee which was pretty bad, causing many to give thanks for instant coffee.

Canned and evaporated milk was used aboard these ships. One boat reported:

Powdered whole milk makes very good cocoa and chocolate milk and is satisfactory on cereal but is not recommended for use as whole milk for drinking.

Another Commanding Officer suggested that powdered milk be provided in small containers to prevent spoilage. Souring of condensed milk was not uncommon. A cream substitute was very popular aboard submarines and was used in coffee and on cereal and fruit. Many cooks used it to fortify canned and powdered milk, serving it as a beverage. It must be kept at an even temperature and sours quickly when opened and left at room temperature.

Fresh eggs were a boon and much appreciated:

Eggs for breakfast was one of the most popular items served.

It was a distinct pleasure to have fresh eggs at the start and end of the patrol instead of the usual canned meat and dried egg omelet.

If available in quantity, enough eggs could be carried to last throughout the patrol. Freshness of eggs was hard to guarantee, especially at advanced bases. Powdered eggs were used with some success in cooking but generally they were not greeted with enthusiasm in taking the place of the "strictly fresh egg."

Difficulty was not uncommonly experienced in keeping butter sweet and palatable.

Eight cases of eggs and 100 pounds of rancid butter were surveyed—brought from the States.

Butter went bad after the first week.

After 2 weeks at sea we found that all the eggs were rotten and the butter rancid.

One submarine experiencing rancid butter "despite excellent refrigeration" recommended a separate butter locker be installed in the cool room.

Another commanding officer reported:

Butter as usual became unpalatable. A special sealed wrapper should be provided to prevent the absorption of all the odors in the refrigerator space.

This, it seems to the authors, is an important suggestion.

Some boats used and recommended canned butter; another boat recommended that all contracts for a special brand of canned butter be cancelled: "No boats should be stocked with it." "Tinned butter should be chilled to avoid running."

In some reports, excess spoilage of certain staple articles—particularly due to the presence of weevils, as in the rice, wheat flour, cereal, macaroni, noodles and cocoa—was reported. Some commanding officers reported that certain brands of canned foods—such as canned carrots, bologna, salmon, and orange juice—were unsatisfactory. In five reports it was stated that the yeast taken aboard was entirely unsatisfactory.

SUPPLY OF VEGETABLES AND FRUIT CARRIED BY SUBMARINES

During the war the quantity of fresh vegetables and fruit that could be carried aboard submarines was limited not only by the amount of available space but by the available supply at refitting bases.

Mention has been made of the importance of potatoes in the submarine diet. Other fresh vegetables and fruit, such as onions, tomatoes, lettuce, carrots, cabbage, apples, oranges, etc., were especially appreciated, particularly in that they lent variety and interest to meals which, without them, became very monotonous.

About the 50th day fruit and fresh vegetables became the usual topic of conversation.

Fresh provisions of an excellent and superior quality should be made available for the crews of submarines on patrol—the importance of this is hard to estimate. We had tomatoes for 2 weeks, onions and cabbage for 4 weeks, lettuce for 3 weeks, and potatoes for 5 weeks.

Loading the icebox with fresh lettuce and tomatoes paid dividends for the first 2 weeks of the patrol.

Fresh provisions taken on at Tulagi were a great help. The lack of frozen foods was offset by an abundance of fresh fruit.

A quantity of locally produced (Surabaya, Java) concentrated lime and lemon juice was carried and proved a delicious and refreshing drink. Since this product was fresh, it is considered to have supplied, in part, the vitamin deficiencies of our ration, due to our inability to stock sufficient fresh food for the entire patrol.

The advent of quick-frozen fruits and vegetables was a boon to the submarine cook and crew. They are convenient, simple to prepare, cook with a minimum of waste, and can be easily stowed. Unfortunately, however, they require refrigeration, the amount of which space

aboard a submarine is definitely limited. Comments regarding this type of commodity were, on the whole, very enthusiastic:

Quick-frozen foods are excellent.

The value of such items as frozen strawberries, corn, beans, peaches, and vegetables cannot be too strongly stressed.

Even a small quantity enlivens an otherwise drab bill of fare.

* * * are worth their weight in gold toward the end of the patrol.

It is unfortunate that the space available restricts the amount of fresh frozen foods that can be taken aboard.

By the institution of rationing, quick-frozen strawberries, peaches, and peas were served throughout the patrol.

Unfortunately, and especially at advanced bases, it was not always possible to supply operating submarines with fresh vegetables and frozen foods in adequate quantities.

The absence of frozen foods was heavily felt and was a great disappointment in view of all the correspondence during the past year regarding the desirability, benefit, etc., of supplying submarines on long patrols with them.

A small selection and quantity of frozen foods were available; supply officers should keep the stock of these items high at all times.

Highly recommend that the high priority assigned this type of food be rigidly enforced—that shore stations and tenders do without to such an extent that operating submarines may benefit.

SPECIAL SUBMARINE FOODS

Several different articles of food, often called "special submarine foods," were especially appreciated because, like fresh and frozen vegetables and fruit, they served wonderfully to relieve the monotony of the regular diet. Moreover, they provided "a maximum of food value in a minimum of space with great keeping qualities and little waste."

Inasmuch as many submarines served only a lunch as the noon meal during submerged operations, canned luncheon meats were highly desirable—as canned ham, meat spreads, vienna sausages, canned boned chicken and turkey, roast beef, potted deviled meats, lamb and beef stew, meat loaf, sardines, shrimps, crab, and lobsters.

Our irreplaceable community stock of canned tuna, shrimp, and crab disappeared during the last refit and was missed by all hands, particularly for the noon meal on all-day dives.

Canned bacon was found very convenient. Tinned soup, mushrooms, peanut butter, pickles, jelly, preserves, mustard, etc., went far in stimulating appetites which, sometimes on long patrols, became dispirited.

Fruit juices of all kinds were much appreciated. And as indicated above, were very important in supplying the vitamin requirements of the ration.

An ample supply of fruit juices is believed responsible for the marked decline in the number of bleeding gums among the crew.

Canned orange juice in a few instances was reported as being bitter and unpalatable. Many submarines carried tomato juice and blends of orange, and grapefruit juice; lemon, lime, and orange concentrates were available, as were powdered lemons. Other preparations included apple, currant, prune, and sauerkraut juice, etc. One commanding officer pointed out the tendency of submarine personnel to consume liquids—in one patrol it might be coffee; another might find the same crew consuming large quantities of tea. On some boats, a carbonated beverage was very popular.

Other suggestions concerning the stocking of submarines with these various food items were:

It is not considered advisable to stock fresh frozen vegetables or fruits, as tinned vegetables and fruits are always available, more economical, easier to store, taste as well, save cold storage space for essential items and have all the nutritional advantages of frozen items.

Most yards and bases have standard items in small pack, such as Nos. 2 or 2½ tins, suitable for use on small submarines. By using this small pack, greater variety of vegetables and fruits can be stored and some waste avoided. Spices, sauces, catsup, etc., are available in small cans or bottles. A wider variety can be carried to season food so it is more appetizing.

DEHYDRATED AND CONCENTRATED FOODS

Dehydrated foods—potatoes, onions, cabbage, carrots, eggs, and soup stock—were available to operating submarines, being recommended to save space on long cruises. As pointed out, 1 pound of dehydrated potatoes makes 10 pounds of mashed potatoes. Powdered eggs were used with success in cooking and baking. When prepared, as scrambled or in omelets, they were not greeted with enthusiasm.

Dehydrated potatoes are palatable when mashed or french-fried. They do not approach the fresh variety.

Only 4 patrol reports out of the 1,458 reviewed showed any enthusiasm for dehydrated foods.

VITAMIN CAPSULES

During the war multiple vitamin capsules were supplied to the submarines. A capsule per day supplied one-half the minimum daily requirements. About 85 patrol reports mentioned having used these capsules, particularly for the lookouts. In general it was felt that the varied submarine ration contained all of the required vitamins. However, in order to be certain of no deficiency, the taking of the multiple vitamin capsules was recommended. That the vitamin intake was ample was evidenced by the fact that only in the earliest months of the war, and then only under the most unusual circumstances, in but two patrols was there any evidence of avitaminosis in submarine personnel.

REFRIGERATION ODORS AND TASTE IN FOODS

As pointed out, submarines are equipped with a chill room and an icebox. These, unfortunately, must be entered many times in a patrol. Food, especially meat and butter, crowded into this refrigerating space, absorbs various odors and becomes "strong."

Toward the end of the patrol food begins to acquire an "icebox" taste.

Fresh meat, although kept at 20° F., again acquired a most unpalatable taste early in the patrol in spite of every effort to locate and remedy the cause. This condition has existed on every patrol. Ventilation was increased, a charcoal filter was installed, and the icebox was inspected by a medical officer without apparent benefit.

Another submarine reported:

The objectionable icebox odor was eliminated by careful observance of cleanliness, stowage, and ventilation of the refrigeration spaces. In two refits the spaces have been scrubbed with soap and water, wiped down with alcohol and aired out with portable blowers for 2 days. Meat and provisions have been stowed in such a manner as to allow the circulation of air. An electric fan was installed to provide circulation of air and temperature was maintained at a low level by limiting the frequency of opening the door to an absolute minimum.

A few boats obtained deodorizing equipment.

Sometimes considerable meat and, in some instances, fresh frozen vegetables were surveyed while at sea. In part, this was undoubtedly due to the poor quality of food issued the submarine prior to her departure on the patrol. It should be pointed out, in this connection, that potatoes which have been frozen, meat which has been thawed and refrozen or which has been removed from a submarine upon the completion of a patrol should never be reissued to submarines. It is true that, wishing to carry enough meat, etc., to last throughout the patrol, iceboxes were commonly loaded beyond their capacity.

The present arrangement of the icebox is not satisfactory. Either a rearrangement of the coils, shelves, and ventilation, or a compromise of each, is required to utilize the present refrigeration space. The excessive amount of meat spoilage (1,000 pounds) shows the necessity of an improvement inasmuch as the icebox was never out of commission.

* * * feel that the increase in personnel over the designed complement necessitates carrying of more food so that proper circulation is not obtained near the bottom of the icebox.

Inasmuch as all running equipment, including refrigeration machinery, was commonly secured during "silent running" in evasive tactics, impressive amounts of meat, etc., spoiled due to temporary rise in the temperatures of the refrigeration spaces.

COOKS AND BAKERS

Unless care is taken in its preparation, the finest of food may prove unsatisfactory.

We had one inexperienced cook. Constant effort and the use of the Navy Cook Book was required on the part of the commissary officer to keep the food palatable.

The commanding officer of another submarine pointed out that "a cook with enthusiasm for his job and inspiration can do much to improve the food situation."

Another stated:

Three unimaginative cooks and the Navy Cook Book are a bad combination for even the hardest working commissary officer.

Only the best cooks obtainable should be assigned to the exacting cooking duties aboard a submarine, and it is believed that between patrols a brief course of instruction in diet and preparation of healthy menus should be given to all submarine cooks by a qualified medical officer.

The practice that some ships followed while in the Bay Area of permitting the ships cooks to take part-time work in the galley of a hotel noted for its cuisine was followed by this command and has paid ample dividends. This is the first good commissary department that we have had in five patrols.

By and large, however, it is believed that most cooks and bakers aboard submarines performed their duties with satisfaction, for they were commended by their commanding officers in 47 of the reports in such glowing terms as:

The cooks and bakers made meals a pleasure.

The unsung heroes of these patrols are the cooks—theirs is a difficult task and one that is always well done.

The abundance of fresh bread, cakes, rolls, and cookies provided by a conscientious cook went a long way in making this a fine ship.

An effort should be made to provide all submarines with a good baker for the morale factor.

* * * who are responsible for the particularly high morale around chow time.

MEALTIME

When there is a break in the normal conditioned routine, some men react unfavorably. A submarine on patrol certainly enforces many violent changes. Some patrol comments relative to this were:

Night was turned into day for meals.

Two meals were served, one in the morning and one in the evening, with soup and sandwiches at noon and midnight.

During the period of all-day dives, breakfast was either cold or cooked prior to submerging, lunches were cold, and a hot meal was cooked and served after surfacing at night.

Meals were served at the regular times with hot soup and crackers available at midnight. This midnight snack became more and more popular as the patrol progressed.

Many of the boats maintained normal meal hours. That the problems of mealtime was not considered important is evidenced by the fact that only 12 comments were made in patrol reports. Yet we know that every officer and man who served aboard submarines was affected. It is interesting to conjecture how much bearing this break in the long-established mealtime routine had on such problems as gastric distress, gastric ulcers, constipation, and even general fatigue.

FOOD POISONING

One of the ever-present worries of every cook or baker is the occurrence of group food poisoning. Such episodes may be not only incapacitating but definitely dangerous. Careful analysis of the patrol reports reveals notations concerning food poisoning only 34 times. Many of these reports mention the occurrence only in general terms, such as:

Sixty-five percent of the crew were mildly affected on one occasion by food poisoning.

Some of the reports listed the offending agents as canned orange juice, canned sardines, custard pie, beef, surveyed cream substitute, spoiled frozen chicken, tinned hash, and tinned salmon. It will be noted that these are the items usually incriminated.

Aboard one submarine, on one occasion, two-thirds of the crew and all of the officers were affected by a most serious ailment identified as "food poisoning."

The source of the poisoning is believed due to frozen chicken which was partially spoiled. The infection, treated by magnesium sulfate followed by tincture of camphor and opium when necessary to control diarrhea, ran its course in 4 to 5 days in all but two cases. The two exceptions were unable to retain food for 5 days and were not fully recovered for 10 days.

The incapacitating nature and serious military significance of this illness may be recognized when it is further explained that mass illness, in part, may have been responsible for the submarine's inability to carry through a successful attack against a Japanese carrier.

For the benefit of medical officers studying the etiological agents of a general poisoning on a submarine, it is well to bear in mind two possibilities in addition to food—the drinking water and a volatile chemical such as carbon tetrachloride. At the risk of seeming to belabor the point, the following pertinent quotation is presented:

The period 6 November to 10 November contained the greatest amount of sickness, about 20 people being sick enough to vomit at this time, and it was necessary to turn 2 men in. This particular period occurred soon after a particularly bad-tasting batch of water was put in use and it is believed to be the cause of the illness. The taste of this water was distinctly like iodine and samples were taken for analyzation. The two more seriously sick men were subject to cramps and pain in the stomach and they were unable to retain any foods or liquids for a period of 5 days in spite of the use of amphotel, soda, paregoric, and rhubarb and soda mixture. Intravenous feeding was finally resorted to in the case of one of these men and after 2 days he was improved sufficiently to go on a liquid diet and 2 days later on a soft diet.

The next patrol of the same ship states:

No evidence of stomach upsets experienced on the two previous patrols was noted. This condition had been attributed to contaminated drinking water. During the last refit period the senior medical officer advanced the opinion that it was caused from inhaling carbon tetrachloride fumes. This liquid had

been carried below decks for cleaning electrical appliances. All carbon tetrachloride was removed from the ship and nothing was done to the fresh water system. It now appears that the trouble had been remedied.

We wish to emphasize again that operating submarines, as judged by the record of the patrol reports, were singularly free from "food poisoning," with a record of only 34 instances out of 1,489 reports studied; and in only 9 of these 34 was food actually incriminated. The entire organization from the senior commissary officer to the most junior cook's striker is to be congratulated.

MISCELLANEOUS

A few interesting and largely unrelated comments concerning food habits of submariners, etc., were observed in these patrol reports. One submarine, early in the war, reported that an average of 1.5 pounds of meat had been used per man per day. Total food consumed averaged 5.6 pounds per man per day—this was a 47-day patrol, made in the vicinity of Truk, 31 days of which were spent submerged. One commanding officer was of the opinion that serving a light lunch at noon "curbed the tendency to overeat from boredom, with a beneficial effect on the crew." Aboard another submarine, also early in the war, "food consumption was observed to fall off noticeably, the decline being most noticeable during the fourth week." Others reported a decline in appetite after prolonged periods of silent running and depth charging. Two commanding officers, following cold weather patrols, reported an increase in food consumption. A third reported that cold weather operations were accompanied by a marked increase in the consumption of coffee (tripled). Others observed difficulty in baking under conditions of increased humidity within the ship. More than one cook on a war patrol has experienced and complained bitterly of collapse of his cakes during depth charge attacks. Two commanding officers encouraged the 'chewing of gum by their crew, one of whom was convinced of its beneficial effects in that it reduced the amount of smoking during depth charging and was believed to account for a "noticeable reduction in the usual number of gastrointestinal complaints usually observed during the course of a long patrol."

SUMMARY

1. The ration provided submarines in World War II succeeded in meeting their somewhat specialized requirements, namely: Ease of stowage, excellent keeping qualities, and ease of preparation in providing a well-balanced daily menu incorporating a maximum of food value, variety, and a minimum of waste.

2. More active participation of submarine squadron medical officers in the problem of supplying men on submarine patrols with a satisfactory ration is indicated.

3. It is urgently recommended that this entire problem be restudied in the less-hurried atmosphere of peacetime with a view toward constructing a master ration plan for the Submarine Service, sufficiently exact to be helpful as a guide and at the same time flexible enough to allow for satisfying individual preferences.

4. The need for more thorough schooling and training of the entire team (commissary officer, commissary steward, cooks, bakers, and supply officers) is apparent and will go far toward eliminating some of the problems of the submarine ration.

5. The one single item of food most common cause for unfavorable comment by commanding officers of combat submarines was the quality and percentage issue of boned beef. A review of this situation, with a view to possible corrective measures, may be in order.

6. With reference to individual food items provided submarines, the following points appear worthy of emphasis:

(a) The significance and importance of ice cream in providing variety in the diet as well as nourishment is apparent. In addition, it rates high as a recognized morale builder aboard submarines.

(b) Submarines should be given a high priority in the obtaining of available supplies of frozen fruits and vegetables, the importance of which, in the submarine ration, has been amply demonstrated.

(c) Certain luxury foods (cream substitute, canned luncheon meats, sea foods, instant coffee, jams, etc.), particularly when available in small-pack size, are important in providing variety and enlivening what may otherwise be a monotonous diet.

7. The foregoing comments are intended not as a criticism of the commissary department of the submarines or the supplying organization, but are merely suggestions designed to make more perfect an already smoothly functioning organization. In fact, from all information available, it is apparent that the submarines in World War II amply earned their reputation of being "the best feeding ships in the Navy."

ACKNOWLEDGMENT.—The authors wish to express their appreciation to C. F. Vaught, Pharmacist, USN, for his assistance in preparing this report.



DENTAL OBSERVATIONS OF NATIVE PUERTO RICANS WITH SPECIAL REFERENCE TO THEIR HABITS OF CITRUS FRUIT CONSUMPTION

WILLIAM A. NEWMAN
Commander (DC) U. S. N.

THE dissolution of tooth substance resulting from the eating of citrus fruits and the drinking of citrus fruit juices has been the subject of various reports in dental literature. Stafne and Lovstedt (1) have reported that certain patients who were using lemon juice as a therapeutic measure also showed evidence of dissolution of tooth structure and that it seemed that marked dissolution of tooth structure may occur as a result of drinking lemon juice. For many years it has been known that acids attack the teeth. The etched teeth of Sicilians who eat large quantities of lemons have been attributed to this (2). Citric acid with a pH 2.6 caused severe damage to the lower molars of rats and hamsters in experiments conducted by Restarski and coworkers (4). The same authors "observed one instance of very severe damage to the teeth of a 32-year-old man, apparently resulting from the practice of sucking the juice from two or more oranges per day over a period of 2 years."

It was suggested by Captain E. G. Hakansson (MC) U. S. N., U. S. Naval Medical Research Institute, that observations concerning the effect of the citrus fruits on the teeth of the natives of Puerto Rico be recorded. These people consume large quantities of oranges and grapefruit. A thin outer layer of the skin of oranges and grapefruit is peeled by means of a sharp knife or a small lathe designed for this purpose. The top of the fruit is then cut away. By kneading with hands and sucking, the juice and some of the fibrous portion are extracted readily. Venders of these prepared fruits are located conveniently throughout the island and customers may eat two or three oranges in that many minutes for a few pennies.

PROCEDURE AND RESULTS

Gross examinations were made of the teeth of over 200 male Puerto Ricans. The subjects' ages ranged from 18 to 65 years. The examinations were made with the aid of dental mirrors and explorers under

good lighting conditions. Questionnaires answered by the natives furnished certain information which appears as a portion of this report.

TABLE 1.

Age group	Under 25	25 to 35	35 to 45	45 to 55	Over 55
Etched tooth enamel percent.	0	1.5	0	0	0
Serumal calculus do.....	77	88	94	72	100
Over 3 upper anterior teeth missing. do.....	11.4	15	23	42	40
Daily average number of oranges and/or grapefruit consumed.....	4.6	4.3	3.8	3.7	3.4

(a) An average of 4.24 oranges and/or grapefruit was consumed daily by the natives observed. This daily average consumption continued during the 5- to 6-month season.

(b) Of all examinations made, only one disclosed evidence of tooth destruction that could be attributed to the effects of citric acid. This finding is directly opposite to that which was expected in view of the findings of those authors referred to previously in this report.

(c) Serumal calculus was found to be present on the teeth of 78 percent of those observed.

(d) Upper anterior teeth were found to be missing in many cases. Our records of examinations revealed that 17 percent of all ages had lost 3 or more upper anterior teeth.

REFERENCES

1. STAFNE, E. C., and LOVESTEDT, S. A.: Dissolution of substance of teeth by lemon juice, acid beverages and acid from some other source. *J. Am. Dent. A.* 34: 586-592, May 1, 1947.
2. McCAY, C. M.; RESTARSKI, J. S.; and GORTNER, R. A., JR.: Effect of Ingestion of acid beverages upon the teeth of rats and puppies. Research Project X-418, Report No. 1, December 26, 1944, p. 2. U. S. Naval Research Institute, Bethesda, Md.
3. PICKERILL, H. P.: Prevention of Caries and Oral Sepsis. 3d edition. Baillière, Tindall and Cox, London. pp. 133-211.
4. GORTNER, R. A., JR.; RESTARSKI, J. S.; BIERI, J. G.; and McCAY, C. M.: Comparison of effects of different acid beverages on teeth of white rats and hamsters. Research Project X-418, Report No. 2, July 18, 1945. U. S. Naval Medical Research Institute, Bethesda, Md.



TUBERCULOSIS PROGRAM ON GUAM INCLUDING AN ALL-ISLAND TUBERCULIN PATCH TEST STUDY

HAROLD JACOBZINER
Commander (MC) U. S. N. R. (Inactive)

TO appreciate the importance and magnitude of the tuberculosis problem on Guam, it is well to point out that in 1940, prior to the war and presumably under normal conditions, tuberculosis was the greatest single cause of death among the native population. It caused 15 percent of all deaths on the island. In 1941 (1) there were 103 new cases of pulmonary tuberculosis reported, and 23 cases of extrapulmonary tuberculosis.

In July 1946, one-half of all the natives hospitalized had tuberculosis. No accurate records were available for the years of the Japanese occupation, December 1941 to July 1944. Undoubtedly the rate was markedly increased due to enforced poorer living conditions, greater congestion, hard work, and under-nutrition.

MORTALITY FROM TUBERCULOSIS

In 1945 there were 39 deaths among natives on the Island from tuberculosis, all forms. Thirty-six of these patients died at the Military Government Hospital No. 203, while three died on the outside. Seven of the deaths were of children, under 5 years of age. These were all cases of miliary tuberculosis. Two were tuberculosis meningitis with miliary involvement. One case showed miliary involvement in every organ of the body, including the heart, testes, and scrotum.

There were 16 male and 23 female deaths among the natives in 1945. The sex variation is explained by the fact that the tuberculosis hospital population is also predominately female, 48 male and 73 female. The general incidence of tuberculosis on the island is also higher in the female sex. (See tables for positive reactors to tuberculin test.) The general island population also has about 500 more females than males out of a population of 23,400 which probably also is not an insignificant figure as a causative factor.

Table 1 shows a break-down of deaths, by age and by sex.

TABLE 1.—Deaths from tuberculosis, all forms, by age and sex, in Guam, 1945

Age (years)	Number	Sex	
		Male	Female
Under 1 year.....	2	2	0
1-4.....	5	2	3
5-9.....	0		
10-14.....	0		
15-19.....	2	1	1
20-24.....	3	1	2
25-34.....	4	3	1
35-44.....	5	2	3
45-54.....	11	3	8
55-64.....	3	1	2
65 and over.....	4	0	4
Total, all ages.....	39	16	23

It is possible that the real reason for the greater incidence of tuberculosis in the female on Guam is due to greater and more intimate contact of the female at home with infected cases or "spreaders"; and, also, because the female generally works harder than the male, and is continuously under more unhygienic conditions and in a state of poorer nutrition and generally below par, especially during the child-bearing period, due to multiple pregnancies. The male, on the other hand is away from home most of the time, either fishing, working outdoors, etc., and is more robust and hence not as susceptible to the infection.

The mortality for tuberculosis in 1946 was about the same as in 1945, about 36 deaths; the disease was the second leading cause of death. Again there were more deaths among females than males. Undoubtedly there were even more deaths of patients with tuberculous lesions than recorded; some probably died of an intercurrent infection, but terminal diagnosis was not entered as tuberculosis on the death certificate as cause of death. Thus, the mortality figures really do not portray the true picture and may greatly underestimate the amount of tuberculosis in the population.

Medlar (2), in a study done at Bellevue Hospital, New York City, from 1935 to 1945, reveals that much information about the tuberculosis problem does not appear in vital statistics.

Seven thousand six hundred and thirty-one complete post-mortem examinations were done on individuals over 16 years of age from all hospital services. One case out of every ten examined revealed tuberculous cavitation. Thirteen out of every hundred with tuberculous cavitations were not recognized clinically. Eight out of every ten of the unrecognized cases were individuals over 50 years of age, while tuberculosis as the cause of death in the whole group showed the highest rate between 16- and 40-year age group. Two out of three of all the "spreaders" of tubercule bacilli were over 40 years of age with many dying from causes other than tuberculosis. Thus, the author concludes

that in the epidemiology of tuberculosis the number of cases "spreading" the infection, not the mortality rate within a certain age group, is the important factor. Opie, McPhedran, and Putnam (3) found that the ratio of existing cases of tuberculosis to tuberculous deaths had a significant racial variation. It was 12.2:1 in the white race and 4.3:1 in the Negro race, indicating a case fatality rate about three times as high in the Negro as in the white.

There are no exact figures for existing cases of tuberculosis on Guam, and thus it is not possible to compute a ratio, but it is perhaps somewhere between the figures for the whites and Negro race. While the incidence of tuberculosis as judged from the tuberculin study is probably not more prevalent among the Guamanians than in whites, the mortality rate is higher and perhaps, like the Negro, the Guamanian is more susceptible to the ravages of tuberculosis, the infection making earlier and more widespread inroads and hence a higher mortality rate.

Sex.—As already stated, the mortality from tuberculosis on the island was greater among the females, as was also the incidence. This occurrence is different from what is found in the United States. Edwards (4) states that during 1935 and 1937, the tuberculosis mortality rate in males greatly exceeded that in females at all age groups, except for those from 10 to 24 years. This was true for both whites and Negroes. The rates were most nearly equal at ages under 10 years. (The same is true on Guam.) They were further apart at ages 35 to 54 years. The rates in Negroes were further apart at ages 65 to 74. The greatest difference on Guam is between the ages of 45 to 64 years, where the rate among females is about twice that of males.

Age.—As is true in the United States, the greatest number of deaths occur in certain age groups. It is highest on Guam among those between the ages of 35 and 54 years, and particularly between 40 and 54, and especially among females.

It is also high among children under 5 years of age, and with no significant difference as to sex.

Eighteen percent of all deaths from tuberculosis was in children under 5 years of age, and they were all cases of generalized tuberculosis or generalized tuberculosis with meningitis combined. Five percent of all deaths on the island of those under 5 years of age was due to tuberculosis. These figures are higher than in white children but not as high as in the Negro population. The Guamanian infant is usually infected from a parent or other close member of the family with whom he is in much closer contact than the white American child usually is, and thus he is likely to receive a greater bombardment of large doses of bacilli at very frequent intervals. His resistance is not as good as that of the "white brother" and thus the infection

becomes more ravaging. The Guamanian child is generally less well nourished and more susceptible to all infections than is the white child. There was no death in 1945 from tuberculosis in children between 5 and 14 years, an age group in which mortality is universally low. The low mortality in the older children (over 5 years) is perhaps due to the fact that by that time the child has already acquired some natural resistance to the bacilli, thus preventing marked inroads of the infection. At puberty, however, due to the stress of a sudden and rapid spurt of growth, resistance becomes lessened again, and mortality rate increases.

Socioeconomic conditions.—Like the incidence, the mortality figures are also higher for villages which are more congested, have greater unhygienic conditions, and in the "boondocks," i. e., out of the way areas, where more primitive conditions prevail.

The mortality rate per 100,000 on the island for 1945 was over 166, compared to 40 in the United States.

It is seen that mortality from tuberculosis on Guam is influenced by the same factors as the world over, namely age, sex, and socioeconomic conditions such as poor housing, malnutrition, etc.

In this study, only one race was considered, i. e. the native Guamanian or Chamorro. When population is mentioned the native population is implied.

HOSPITAL FACILITIES FOR TUBERCULOUS PATIENTS

Almost up to the end of the war, the hospital bed facilities were entirely inadequate for the isolation and proper care of patients suffering from tuberculosis. In 1941, construction of a new building with 65 beds for the care of tuberculous patients was almost completed when the Japanese invaded Guam. It was used as a general hospital by the Japanese during their occupation.

When we recaptured the island, the building was the only one which remained on the hospital compound intact. It was therefore used as The Civilian Affairs Hospital for all native patients until the new hospital, a group of Quonset huts, was built. About January 1945, the original tuberculosis hospital of 65 beds was converted to its intended use, i. e. for care of tuberculosis patients. Although its bed capacity was only 65, it housed over 100 patients; needless to say, under very congested conditions. There was therefore a marked lack of hospital beds for the tuberculous.

This situation was markedly relieved in February 1946 when the Military Government Hospital No. 203 moved into its present quarters (the Old Fleet Hospital, One Eleven). Ample ward space was provided in this large hospital and five wards were selected for the tuberculosis service. Positive cases were put in separate wards from

negative cases, and the congestion was tremendously relieved. There was ample space and bed capacity in the hospital compound to increase the number of tuberculosis beds as needed.

TABLE 2.—*Hospital patients with tuberculosis, all forms, by age and sex, in Guam, June 1946*

Age group in years	Number	Sex	
		Male	Female
Under 1 year.....	1	0	1
1-4.....	3	2	1
5-9.....	6	3	3
10-14.....	10	6	4
15-19.....	12	3	9
20-29.....	35	10	25
30-39.....	19	11	8
40-49.....	22	7	15
50-59.....	8	2	6
60 and over.....	5	4	1
Total, all ages.....	121	48	73

The main problem now was to get the active cases into the hospital, to find the "spreaders," to isolate, treat, and rehabilitate them and mainly to prevent spread of the infection.

In June 1946, there were 121 patients in the hospital with tuberculosis, 48 males and 73 females, about 50 percent of the entire hospital population. (See table 2 and fig. 1.) Seventy-nine of these patients were admitted in 1944. There were almost as many patients admitted to the hospital in the first 5 months of 1946 as during the entire year of 1945. The increase was not due to a rise, however, in incidence of tuberculosis, but rather to a greater availability of bed capacity and, largely, because more cases were diagnosed on random examinations (such as for food handlers requiring an x-ray examination before placement; and also since travel to the continental United States was again permitted to some natives, every applicant for a visa was compelled to have a physical examination and an x-ray). Thus many cases of tuberculosis in apparently healthy individuals applying for certain type of work or wishing to travel to the United States were discovered on chest x-ray examination and hospitalized for treatment.

Thirty-three males and thirty-eight female patients had a positive sputum. The rate of positive sputa cases in the male was therefore actually much higher than in the female, for there were only 48 male patients at the hospital and 73 female, or 68.7 percent of the total male patients and 52 percent of all female patients.

Twenty-one male and twenty-three female patients received collapse therapy.

Of the 121 patients with tuberculosis, 7 also had extrapulmonary bone involvement, and 1 had tuberculous cervical adenitis and active

pulmonary involvement; 4 had Pott's disease, 3 had tuberculosis of hip; and one had tuberculous mastoiditis.

These were all in children from 5 to 15 years of age. One infant 5 weeks old was admitted from the pediatrics service with pulmonary tuberculosis. Her mother died from tuberculosis soon after childbirth. The infant was still alive and doing well 1 year after admission. It is possible that the infection in this case was of congenital or of intrauterine origin.

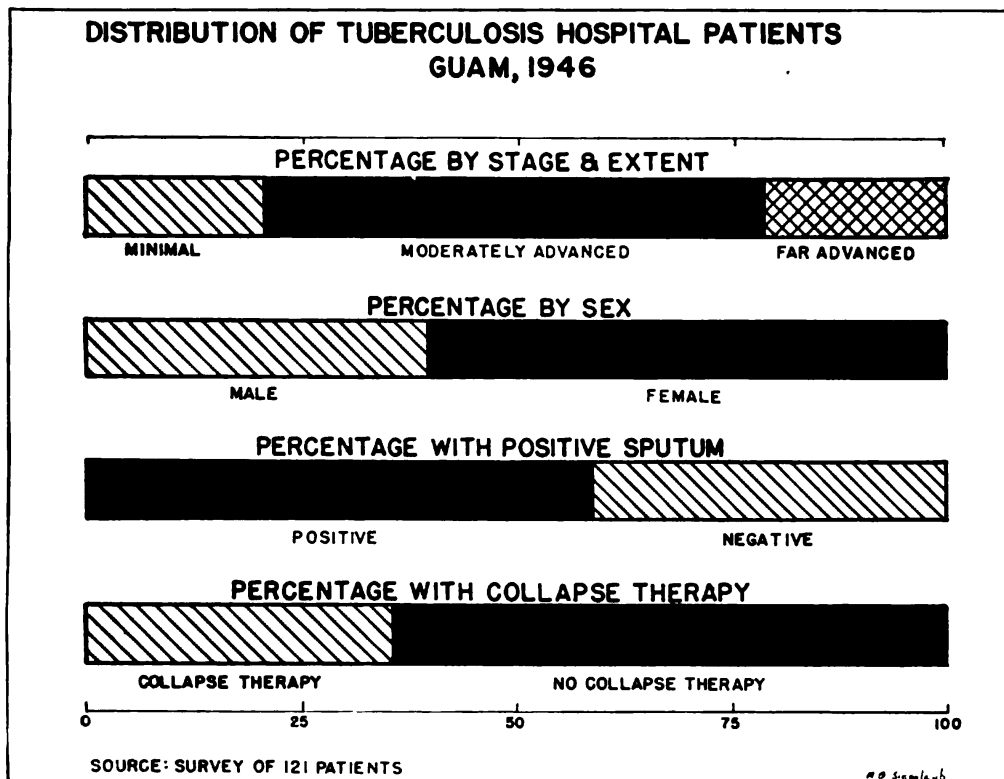


Figure 1.

Out of a total of 121 tuberculosis hospital patients, only 25 had minimal tuberculosis while 70 had moderately advanced and 26 suffered from far advanced tuberculosis.

It is apparent from the above figures that only 20 percent of the patients hospitalized were suffering from minimal tuberculosis. The only reason for this distribution is the failure to recognize incipient tuberculosis or the asymptomatic form sufficiently early. Almost 80 percent of all tuberculosis hospital patients were not admitted nor diagnosed until they were either already moderately or far advanced.

A study made in Tennessee in 1945 (5) disclosed similar findings. A comparative study was made in case finding by means of x-ray examination both in the Health Department chest clinics and on a mobile unit. In order to compare results of these case-finding pro-

cedures, only the first examinations in the Health Department clinics were used. Over 500 people 12 years of age and over were examined for the first time in the Health Department chest clinic during the period of study. Of the 91 new cases found on the mobile unit, 20, or 22 percent, were active, while of the new cases found in the Health Department chest clinic 22, or 50 percent, were active. Of the new active cases in the Health Department clinic, 77 percent were far advanced and moderately advanced, and only 23 were minimal: while of those found on the mobile unit, only 20 percent were far advanced and moderately advanced, and 80 percent were minimal. During the study period, 16 new minimal active cases were discovered through the mobile unit and only 5 in the Health Department clinic.

It is obvious from the Tennessee study and from a study of the extent and activity of the distribution of tuberculosis patients on Guam that only 20 percent of minimal tuberculosis is discovered clinically, and that only moderately and far advanced cases are discovered because of symptoms or clinical examinations. Thus, in order to discover the minimal asymptomatic or incipient active cases of tuberculosis, it is necessary to do case-finding studies in apparently healthy populations. However, both services, chest and case-finding studies have their value in the control of tuberculosis.

TUBERCULIN CASE-FINDING STUDY

A study of the extent and activity of the patients hospitalized with tuberculosis disclosed that 80 percent of minimal tuberculosis goes undiscovered.

Since patients hospitalized in the early stages have the best means for recovery, and since only by finding and isolating "spreaders" or infected persons in the so-called "healthy" population would it be possible to curtail the spread of tuberculosis, a study to detect the incidence of tuberculosis infection in the native population was undertaken. X-raying the entire population was physically impossible due to a lack of trained specialized personnel and to a lack of x-ray facilities. At times there was not even enough x-ray film available for the routine periodic x-ray of the hospital patients. A tuberculin-test study was resorted to, therefore, to discover the incidence of positive reactors. A register was compiled and kept of each positive reactor, by community. The register is at the Guam Memorial Hospital, so that when sufficient personnel and equipment become available all the positive reactors can easily be called in and x-rayed. The Vollmer patch test was employed because of its simplicity and relative accuracy. Two case-finding studies were made. A survey among the high-school students and an all-island survey.

The tests were applied according to the technique outlined by Vollmer, and always under the personal supervision of the author. A small number of high school students were given duplicate tuberculin tests to determine the relative efficiency of the Vollmer patch test, or the correlation with the Mantoux test. Approximately equal numbers for both sexes were given a Mantoux test of 0.01 mg. dose of O.T. (old tuberculin) according to the standard technique, and done personally by the author; and a Vollmer patch test was also done at the same time.

Another group of 79 students were given a Vollmer patch test and a 0.1 mg. of O.T. Mantoux test.

In the 103 students on which a patch test and an intradermal test of 0.01 mg. O.T. was done at the same time, 54 were positive to the patch test, and 52 to the 0.01 mg. intracutaneous test. Thus 52.4 percent were positive to the 0.01 mg. O.T. Mantoux test. The patch test was superior to the 0.01 mg. O.T. dose Mantoux test for the 0.01 mg. O.T. Mantoux test was only 96.3 percent as efficient as compared with the Vollmer patch test in this group.

In the second group of 79 students in whom both a 0.1 mg. O.T. Mantoux test was done and a patch test at the same time, 43 or 54.4 percent students reacted positively to the Mantoux test, and 41 or 51.9 percent to the patch test. The patch test in this study being 95.4 percent efficient as compared with a single dose of 0.1 mg. O.T. Mantoux test.

The above findings demonstrate that the patch test is superior to the 0.01 dose O.T. intracutaneous test and is 95.4 percent as efficient as 0.1 mg. O.T. intracutaneous test.

Edwards (4) found in a correlation between the Mantoux and patch test study, the patch test to be only 92 percent as efficient as the Mantoux test. We can't offer any reasons why we obtained a higher correlation. However, from our findings it was decided that the patch test is sufficiently accurate to be employed for an all-island screening test because of its greater simplicity.

Our results of patch test study in the high school group showed a total percentage of positive reactors of 54.8 percent, the incidence being higher in the females than in males, 45.6 percent positive reactors in males as compared with 62.1 percent in females. Four hundred and twenty-one male students and five hundred and thirty-three female students were examined. (See table 3 and fig. 2.) The percentages beyond the age of 23 are probably not truly reflective of the true incidence in these age groups due to the small number tested in these ages.

It is seen that, on the whole, the incidence rises with age—which is expected and universally true. The reason for the higher rate in the female was suggested in this article when mortality was discussed.

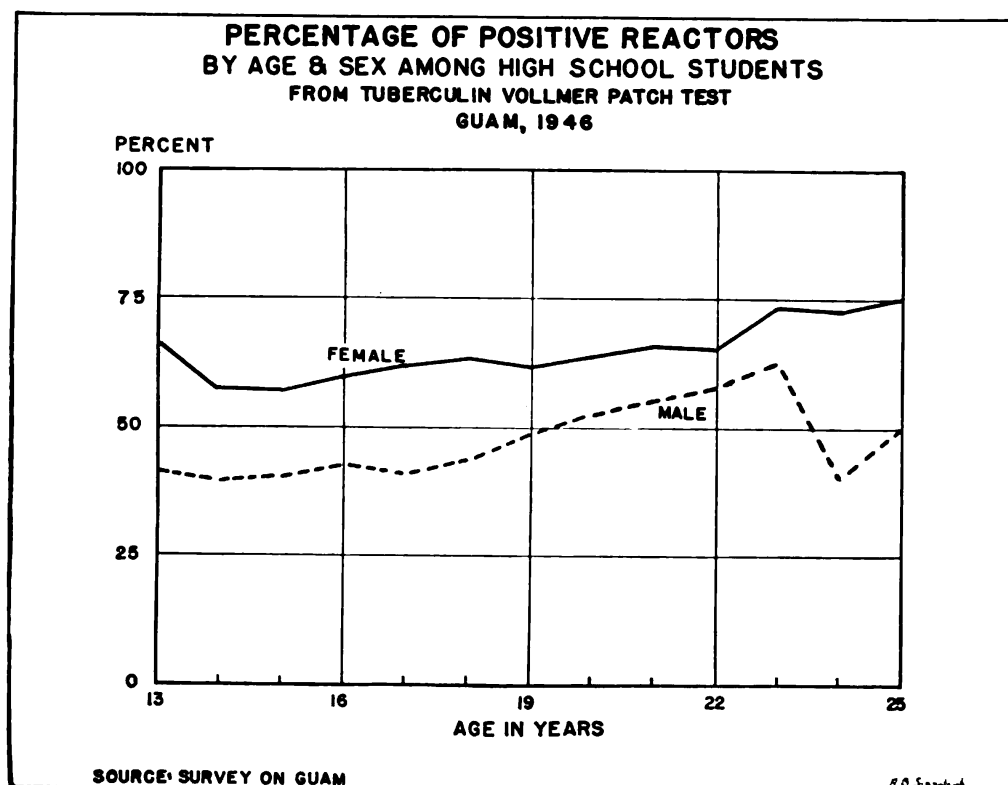


Figure 2.

TABLE 3.—Tuberculin patch test survey on high school children on Guam, 1946

Age (years)	Males			Females		
	Number tested	Number of positive reactors	Percentage, positive reactors	Number tested	Number of positive reactors	Percentage, positive reactors
13.....	17	7	41.1	30	20	66.3
14.....	28	11	39.2	51	29	56.9
15.....	35	14	40.0	58	33	56.9
16.....	54	23	42.5	94	56	59.5
17.....	73	30	41.0	81	50	61.7
18.....	62	27	43.5	46	29	63.0
19.....	47	23	48.9	39	24	61.5
20.....	42	22	52.3	41	26	63.4
21.....	29	16	55.2	32	21	65.6
22.....	19	11	57.8	23	15	65.2
23.....	8	5	62.5	19	14	73.6
24.....	5	2	40.0	11	8	72.7
25.....	2	1	50.0	8	6	75.0
Total.....	421	192	45.6	533	331	62.1

Combined totals: Number tested, 954; number of positive reactors, 523; percentage positive reactors, 54.8

The incidence of tuberculosis in the high school population of Guam is not significantly higher from the figures obtained by Edwards (4) in a Vollmer patch test study in 1938 on 6,330 high school students, both white and Negro, in New York City. He found 45.5 percent positive reactors, 45.3 percent males; and 46.2 percent positive reactors in the female. The rate did not differ appreciably in male and female but increased progressively with age.

In a second group of high school students in 1938, Edwards gave two test doses of tuberculin, 0.1 mg. and O.T. followed by 1 mg. if the reaction to the first dose was negative. Out of two thousand, 583, or 54.5 percent, reacted positively to one of the two tests used.

In a 1940-42 unpublished study about 20,000 National Youth Administration enrollees of New York City and Long Island, who were between the ages of 17 and 25 years, and who comprised about 30 percent Negroes, we found with 0.01 mg. O.T. Mantoux test a prevalence of positive reactors of 52.9 percent; 52.22 percent positive reactors among male white, and 44.04 percent positive reactors among white females. In the Negro male, 68.69 percent reacted positively and 61.87 percent positive reactors were obtained in the Negro female. The incidence also rose progressively with age in each group in both sexes.

Soper and Wilson (6), in a case-finding study on undergraduate and graduate students, demonstrated the effect of age as a factor in the incidence of tuberculosis. They tested 5,876 Yale freshmen students and found an incidence of 0.23 percent chronic pulmonary tuberculosis, while among 4,766 graduate students the incidence was 1.42 percent. The average age of the freshmen was 18.6 years, whereas that of the graduate group was 24.6 years. Thus the older group showed five times as many cases of chronic pulmonary tuberculosis as the undergraduate group.

Sex.—Dr. Edwards did not find in the first group any appreciable sex difference in the Vollmer patch test study among 6,530 high school students of which 5,251 were males and 1,279 females.

All the positive reactors in the high school on Guam, 192 males and 331 females, were x-rayed. Three cases of pulmonary tuberculosis were found among the males, two cases with minimal tuberculosis and one arrested case.

In the female group x-rayed, 2 cases showed moderately advanced tuberculosis, 4 cases had minimal tuberculosis lesions, and 1 case was arrested. Four cases had positive sputum. All the patients, except the arrested cases were isolated and hospitalized and contacts were x-rayed. All patients in whom active chronic pulmonary tuberculosis was found were over 17 years of age, again showing the same universal tendency of tuberculosis to occur in the older adolescent. Out

of 192 positive reactors in the male, we found 3 cases of chronic pulmonary tuberculosis, or 1.5 percent. Since the total number of males tested was 421, the percentage of active pulmonary tuberculosis among the entire male high school population (using the patch test and the x-ray of the positive reactors as screening methods) was 0.7 percent. In the female students a rather higher incidence of active pulmonary tuberculosis was found.

Of the 331 female positive reactors, 7 tuberculosis cases, or 2.1 percent of all positive reactors, were found on x-ray. Since the total number of females tested was 533, the incidence of chronic pulmonary tuberculosis in the female high school students was 1.3 percent as compared with 0.7 percent in the male students. Out of a total of 954 high school students examined, only 2 cases or 0.2 percent, showed arrested pulmonary tuberculosis.

Of a combined total of 954 students examined, 10 cases of chronic pulmonary tuberculosis was discovered, 8 of whom were active and clinically significant, with 4 having positive sputum.

Of the clinically significant cases, 2, or 25 percent, were moderately advanced; and 6, or 75 percent, were minimal.

TABLE 4.—*All-island tuberculin test survey on Guam, 1946*

Age (years)	Males			Females		
	Number tested	Number of positive reactors	Percentage, positive reactors	Number tested	Number of positive reactors	Percentage, positive reactors
0-5 months	65	1	1.5	183	19	10.3
6-11 months	83	4	4.8	194	22	11.3
1	197	22	11.1	304	38	12.1
2	310	33	10.6	347	55	15.8
3	288	46	15.6	333	57	17.1
4	308	57	17.8	328	58	17.6
5	402	90	22.3	385	73	18.9
6	414	92	22.2	346	84	24.2
7	388	94	24.2	339	112	33.0
8	394	132	33.5	320	118	36.8
9	310	132	40.2	297	123	41.4
10	308	128	41.5	288	125	43.3
11	298	129	43.2	367	164	44.6
12	312	135	43.2	298	141	47.3
13	287	153	50.3	293	148	50.5
14	268	133	49.9	265	136	51.3
15	189	97	50.1	291	155	53.3
16	163	94	57.6	309	166	53.7
17	109	58	58.0	243	145	59.6
18	117	64	54.7	198	116	58.5
19	167	95	56.8	189	110	58.2
20	176	105	59.6	209	132	63.1
21	116	63	54.3	176	118	67.4
22	109	62	56.9	179	117	65.3
23	87	48	56.3	197	133	67.5
24	212	128	60.3	216	144	66.6
25-30	385	238	61.8	576	383	66.4
30-35	473	312	65.9	653	458	70.1
35-40	410	258	62.9	502	376	74.9
40-45	436	262	64.0	447	327	73.3
45-50	389	217	55.6	349	246	70.4
50-60	388	191	48.6	336	219	65.1
60 and over	280	100	35.7	289	176	60.9
Total	8,838	3,773	42.7	10,246	4,994	48.7

Combined totals: number tested, 19,084; number of positive reactors, 8,767; percentage positive reactors, 45.9.

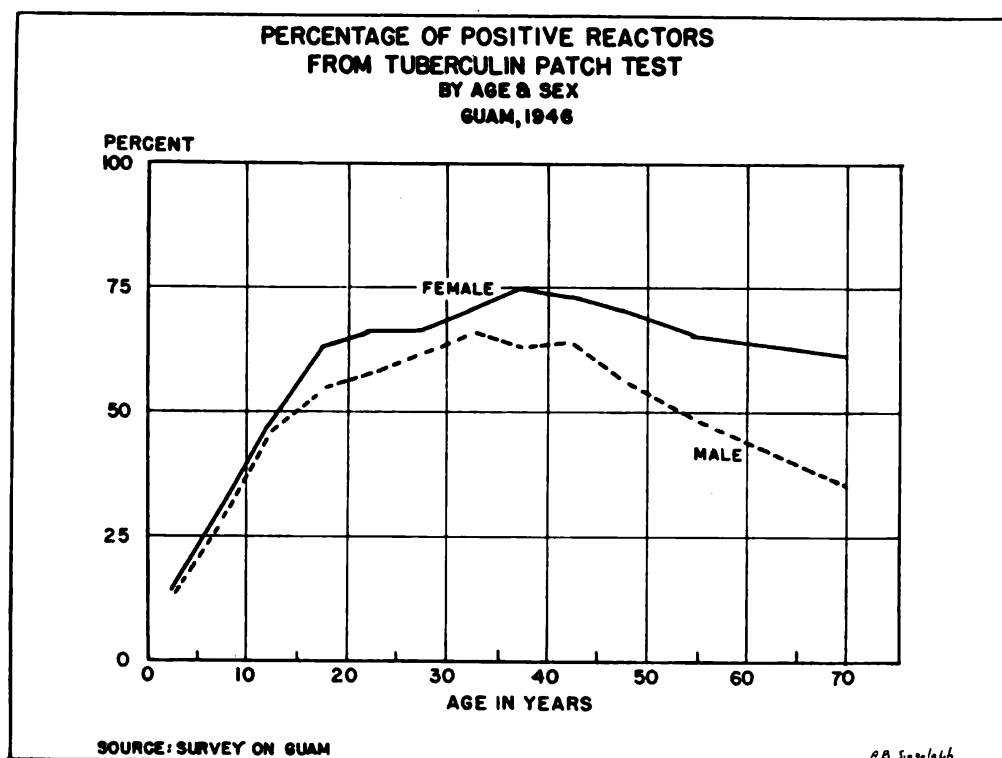


Figure 3.

All the active cases were isolated, hospitalized, and were doing well at the time of our departure in August 1946.

The incidence of chronic pulmonary tuberculosis among the Guam high school students is not much higher than found in similar age groups in this country, but like the Negro, the resistance of the Guamanian is lower and thus the disease makes greater and more rapid inroads.

In addition to the high school case-finding study, an all-island patch-test study was also done at the same time. A few figures about the population may be of value. The total native population is over 23,000; of this number, 11,400 are males and 11,900 females. There are over 7,000 school children on Guam, both in the elementary and secondary schools, or almost 30 percent of the entire population. There are about 5,800 males, 16 years and over, and about 6,500 females in the same age group, about 700 more females than males.

In the group of 15 years and under, there are 5,400 males and 5,150 females, or 250 more males.

There are also a few hundred of mixed ancestry, Japanese, Hawaiians, Filipinos, Marshallese, Saipanese, etc.

In the all-island case-finding study, the patch test was used in the manner and technique prescribed by Vollmer. Nineteen thousand and eighty-four readings were done. Of the 8,838 males, 3,773, or 42.7 percent showed a positive reaction. Of 10,246 females, 4,994, or 48.7

percent, gave a positive reaction. The over-all percentage for both sexes was 45.9 percent. There was no sex difference in percentage of positive reactors up to age 15. From then on it was higher in the females. (See table 4 and figure 3.)

The reduction of positive reactors, especially in the male, after 54 years is hard to explain. However, it may be due to a general debility of individuals tested in this age group, to a loss of allergy, local skin condition, or mechanical factor, possibly wetting of the skin surface, etc. Up to the age of 45, however, in both sexes there is a continuous rise in the incidence of positive reactors with age. It is higher in the female from the age of 15 onwards among the Guamanians.

A possible reason for the higher incidence in females on Guam was suggested previously. Although Edwards and the American Student Health Association did not find any significant sex difference in the incidence of chronic pulmonary tuberculosis, Boynton (7) at the University of Minnesota found incidence of chronic pulmonary tuberculosis among the female students to be twice that of the male students. Dr. Holm (8) reports that in Berlin in 1946 there were five times as many cases of tuberculosis among men as among women in the 18 to 40 age group, and points out the contrast with the situation existing there after World War I when female adults were especially affected. No explanation is offered by him for this reversal.



Figure 4.—Patch test readings, Yona Village. Individuals are lined up according to sex to facilitate tabulations. Native interpreter assists in eliciting correct age. Natives find it difficult to state exact age.

Incidence of active pulmonary tuberculosis.—In a review of the literature covering over 1,000,000 examinations of apparently healthy individuals, Bloch et al. (9) reported in 1938 on the basis of over 1,000,000 examinations that about 1.5 percent of the adult population have active pulmonary tuberculosis, and found 0.83 percent significant tuberculosis lesions in over 97,000 college students.

While we did not x-ray the positive reactors in the all-island group, and therefore do not know the exact percentage of clinically significant tuberculosis or reinfection type tuberculosis in this group, it is logical to assume that it is as high as in the high school group.

Socioeconomic conditions also play a definite role in the incidence of pulmonary tuberculosis. While there is no real poverty on the island—for it is a land of plenty where, due to gifts of nature, no one need go hungry—there are differences in standards of living, nutrition, and hygienic conditions.

TABLE 5.—*Incidence of tuberculin positive reactors by district or community, Guam, 1946*

Name of community or district ¹	Percentage, positive reactors (Vollmer patch test)	Name of community or district ¹	Percentage, positive reactors (Vollmer patch test)
Sinajana.....	40.7	Talofofo.....	48.5
Merizo.....	41.4	Agat.....	50.8
Barrigada.....	41.9	Anigua.....	52.3
Inarajan.....	42.4	Asan.....	53.4
Price School.....	42.7	Piti.....	55.8
Chalan Pago.....	42.8	Toto.....	56.4
Umatac.....	43.2	Yona.....	56.7
Agana.....	44.6	Tamuning.....	57.5
Dededo.....	46.3	Yigo.....	61.8

¹ Arranged in order of lowest to highest incidence.

The incidence of positive reactors was highest in areas or districts where there was greater congestion and more unhygienic living conditions. (See table 5.) It may be said, however, that from our case-finding studies it is fair to conclude that while the mortality rate on Guam is much higher than in the United States, the incidence of chronic pulmonary tuberculosis on Guam is not appreciably higher.

TUBERCULOSIS CONTROL PROGRAM

Tuberculosis control program on Guam, as is true everywhere, must be based on the infectiousness of the disease, must aim to prevent infection and reinfection of individuals as a result of contact and exposure to open cases. It must rest, therefore, on the following fundamental principals: case finding, case supervision (including treatment and rehabilitation), and health education.

CASE FINDING

Unlike other civilian communities, the reporting of the newly discovered case is no problem at all on the island. The entire medical service is supplied and administered by the U. S. Navy Medical Department with Navy medical officers. There is one native physician on the island, a Dr. Sablan, who is also employed by the Navy part time for follow-up of the contacts. The chief problem therefore is case finding, the discovery and early diagnosis of infected individuals.

While we have no exact figures available, it is fair to assume from the mortality figures, our case-finding studies, and general knowledge of tuberculosis, that there must be from 1.5 percent to 2 percent of the population suffering from chronic pulmonary tuberculosis. Thus instead of the 121 known patients, there must be about 350 cases with clinically significant tuberculosis, or over 200 cases still living in homes and "spreading" the disease in their respective communities. An effective case-finding program is predicated on the establishment or existence of a tuberculosis control program. The tuberculosis control service must include:

(a) *A tuberculosis hospital* with sufficient bed capacity to house all active cases of tuberculosis. Preventorium for observation cases and negative sputum cases.

(b) *Tuberculosis chest clinics* for follow-up of contacts, arrested cases, etc., and a diagnostic service for screening tests and detection of early and newly discovered cases.

(c) *Follow-up service* including visiting nurse service of contacts of newly reported cases.

(d) *A health education program*—last but most important, for a proper understanding of the disease and a good preventive program will eventually wipe out tuberculosis from the island.

Case finding is the first basic factor in the control of tuberculosis, for tuberculosis cannot be eradicated before the unknown cases are found. The small number of cases found in the initial stage points to need of better case-finding methods. The best method would be to x-ray or tuberculin test and x-ray the positive reactors at periodic intervals every 2 or 3 years.

Since the total native population is only about 23,500 and since the island is only about 30 miles long and contains about 16 or 18 villages, it would not be a very difficult task for a mobile unit to travel from one community to another and x-ray the entire island native population periodically.

We have compiled a register of all positive reactors and it can serve as a nucleus for a mass x-ray study when personnel and equipment become available. Another effective method would be to do it on a more limited and selective basis, to start with the areas in communities

which have the highest incidence of positive reactors. Since it is known that tuberculosis is mainly a disease of the adult population, and since 65 percent of the hospital patients on Guam are between 20 and 40 years of age, and since highest incidence of positive reactors is between 20 and 50 years, another effective method would be to concentrate on this all important age group and on *all* contacts of newly discovered and heretofore unknown cases.

The second basic factor in a tuberculosis control program is to isolate the newly discovered cases as potentially dangerous to the community, so that they will not continue to spread the infection. Every known active case ought to be hospitalized, both for his own good so that he may be treated promptly and rehabilitated, but more so for the protection of the community. Early hospitalization of a case of tuberculosis yields the best returns to the patient, for it affords the best chances for ultimate recovery and rehabilitation, and it is of greater advantage to the community by the removal of a source of infection. It is therefore recommended that a special tuberculosis hospital and not just tuberculosis wards in the general hospital be erected within hospital grounds sufficiently large to care for all active cases of tuberculosis on the island. The hospital should be staffed by men and women skilled in the treatment of tuberculosis. This includes both the medical and nursing staff. The hospital should be well equipped and afford the latest and most modern methods of treatment. Great attention must be paid to the physical appearance of the hospital and grounds. It should be located in a fine landscape and scenic beauty, so as to make the stay of the patients at the hospital as attractive as possible. One cannot overestimate the desirability of early detection and early hospitalization of every active case of tuberculosis.

In addition to a 300-bed tuberculosis hospital as described above, a tuberculosis preventorium for about 150 patients, similar to the leprosarium now on the island should be erected in an ideal spot to house, care, and observe doubtful and negative sputum cases, not in need of any special form of therapy or constant medical supervision.

It may be used as a stop gap between the hospital and the patient's return to his community and complete rehabilitation. This preventorium can be used not only as a place for the observation of doubtful or inactive cases, but for the after care and partial rehabilitation of the active case after the patient is no longer in need of active hospitalization and treatment.

There the patient may be taught under careful supervision, after his recovery from the infectious process, how to increase his activity, and in some cases to be retrained for some other gainful but less strenuous employment. There also the patient may be taught facts concerning

the disease, how to readjust himself on his return to home and native community, hygiene, and the need for constant follow-up and supervision.

An experimental farm to be used as a form of occupational therapy also should be established at the preventorium.

A well-planned and diversified recreational program should also be instituted. It will help to keep the patients happy and occupied by utilizing much of their free time in forms of recreation which they will enjoy.

A tuberculosis chest clinic must be an integral part of any tuberculosis control service program. It should be located on the hospital grounds and staffed by members of the tuberculosis hospital.

It has a dual function:

(a) To examine known cases, follow-up arrested and inactive negative sputum cases periodically. It may also give limited ambulatory treatment (collapse therapy, etc. and diagnostic aid).

(b) Its chief function, however, is as an aid in case finding by follow-up of contacts of active cases and examination of patients referred from the various village dispensaries because of symptoms for a definite diagnosis. It will be of inestimable aid to the hospital corpsmen in the outlying dispensaries, to the doctors in the general dispensary and general services as a diagnostic aid, and will undoubtedly uncover many heretofore unknown cases of minimal and moderately advanced tuberculosis.

FOLLOW-UP SERVICE

The follow-up of contacts of active cases at the present time is woefully inadequate due mainly to shortage of personnel, both medical and nursing. Only one busy native physician is engaged part time without any nursing personnel to aid him in this very important work. In addition, a lack of sufficient x-ray facilities and necessary important data contribute to the incompleteness and inadequacy of the service. It is therefore urged that a complete and adequate follow-up service be established as an integral part of the tuberculosis control service program. It should include the services of a full-time medical officer and in addition about six district public health visiting nurses, each one in charge of a given area on the island. These nurses preferably should be native Guamanians, Navy-trained, instead of imported American or Navy nurses. The native nurses would have no language difficulty; they know the people, their customs, habits, traditions, characteristics, and shortcomings. In many instances they know their family histories, including past illnesses, etc., and thus would be able to obtain very important data which an American nurse may fail to obtain from an evasive patient. For the same above-mentioned reasons, the native

nurse also may serve better as a health educator and advisor than the imported nurse.

The follow-up service should also concern itself with immediate and careful examination (including x-ray) of all contacts of newly discovered active cases. It should try to track down and trace the source of infection. It should try to obtain accurate and complete data on every case. Importance of giving these cases early attention cannot be overemphasized. Periodic home visits should be made on all arrested cases and inactive cases twice yearly. The follow-up service should urge and induce all patients with active tuberculosis to enter the hospital as soon as possible. Finally, it should concern itself with the after care and rehabilitation of the patient. It should aid both the family and the patient in this trying period of readjustment. A complete register should be kept of all cases of tuberculosis, both active and inactive, with salient notes on the progress of each case.

HEALTH EDUCATION

We believe health education to be the most important single factor in the ultimate control and total eradication of tuberculosis on Guam.

It must be, however, a total health education program, positive and continuous for the entire population. The educational program must be inclusive and cover all phases of tuberculosis and its control. It must deal with the mode of onset, its infectiousness, its spread, methods of cure, and, above all, its prevention.

Native participation in the program is extremely essential and would prove very productive and effective.

Having lived intimately with the native population for about 18 months and having observed their habits and reactions, we are convinced that with an understanding and sympathetic attitude it would be a relatively easy task to obtain the wholehearted support and co-operation of the native population. Unfortunately, at the present time the patients evade follow-up and admission to the hospital. This attitude, however, is primarily due to a lack of any understanding or basic knowledge about the disease and a consequent fear of the disease. These people know nothing whatever about the disease, its implications, its methods of spread, its complications, cure, etc. All they know is that though they feel presumably well, they are removed against their will to a hospital, uprooted from their home, community or business, and their ordinary way of life, and from past experience believe that they probably will be doomed to die at the hospital. As a highly freedom-loving, happy and carefree people, they naturally resent this interference. Since they also don't understand the principles and reasons for the isolation precautions they actually don't observe it although they are a law-abiding people. Anyone walking into a tuberculosis ward could find clusters of patients sitting on each

others bed, positive and negative sputum cases mingling freely together, mixing with visitors, and often visitors kissing active open cases. There were even several cases of pregnancy in girl patients during their course of hospitalization. It must be emphasized that these offenses are not due to hospital maladministration. The hospital staff did an excellent job with the limited personnel available. Failure to obey the rules was entirely a result of ignorance of the nature of the disease, and especially its mode of spread, and the innate friendliness and gregariousness of the Guamanians. To attempt to enforce better isolation procedures and to stop the infractions would have required an individual sentry for every patient. A few incidents may be worth relating to emphasize the need for a total broad program of public health education regarding tuberculosis which should encompass, in an elementary manner, all its various phases and ramifications.

It has been the practice at the hospital, the wisdom of which may be questioned, to allow patients liberty on request for week-ends on the recommendation of the ward medical officer, primarily to raise the patient's morale and, at times, as a therapeutic test.

Every patient in the tuberculosis wards would promptly file a request weekly for week-end liberty, giving most often the following reasons for his request:

"I must attend to my business."

"I have to attend a party."

"I must be present at my sister's wedding."

"I must attend my brother's funeral and make arrangements for it."

Each patient firmly believed it to be a valid reason, though it implied mixing with people and possible spread of the disease.

It was common practice on the part of the patients with advanced tuberculosis to try to bribe the ward medical officer to recommend their discharge from the hospital. Many patients, when granted liberty, fail to return to the hospital on the expiration of their "leave."

This general lack of cooperation and refusal or evasion of a newly discovered case to enter the hospital promptly for treatment stems only from one cause—ignorance of the disease and consequent fear.

The usual refrain encountered from every newly discovered asymptomatic case is "I will come in at some later date"; "I have to open a new business"; "I am busy; I can't come to the hospital now," etc. A very glaring example occurred only a short while before our departure from the island. A nephew of a prominent native on the island was to leave for the United States to study. A routine x-ray is required of all those applying for permission to go to the United States. On the routine roentgen plate it was discovered that this man was suffering from advanced pulmonary tuberculosis. The applicant was

promptly notified and asked to come to the hospital immediately and was told that early hospitalization offered a good chance for an early recovery. The patient agreed but failed to come in. The uncle, a very intelligent person, was called in and was asked to persuade his nephew to enter the hospital promptly. Several days later uncle and nephew arrived for a conference and asked for permission to allow the applicant to go to the United States to study and be treated there. When permission was not granted, the patient insisted on remaining home and being treated by a private physician. This request was unfortunately granted although it was obvious that for his own welfare and the welfare of his immediate contacts, hospitalization would have been preferable.

The patient's attitude was not singular. It was the general prevailing attitude, and due solely to a fundamental basic lack of knowledge of the nature of the disease with which they have become afflicted. If left alone no one would follow instructions, normal hard work would be resumed, and in many instances patients would be on a poor diet and living, in general, under substandard hygienic conditions.

Thus before any tuberculosis control service program can be in any way effective in Guam, a broad public health education program must be instituted. All available means must be utilized to educate the entire native population about tuberculosis spread and prevention.

The movies would offer a splendid medium, for they are all rabid "movie goers." The church is another very potent factor. The commissioners (mayors) of the villages and the school teachers could also play an extremely effective role in the health education campaign.

The Guamanian's love for a contest may be utilized to great advantage in inter-village rivalry about tuberculosis control. This was well demonstrated during the patch test study when every commissioner was tireless in his efforts in order to have the best showing for his village.

Tuberculosis control and total eradication is possible on Guam in spite of the fact that it is at present a very major health problem. Although tuberculosis is now the second leading cause of death and accounts for more than 50 percent of the entire hospital population, it can be drastically curtailed and, eventually, totally eliminated at a rather proportionately low cost if an effective control service program be instituted. There are several contributory factors favoring the control and total eradication of the disease on the island.

(a) It is an island of small communities.

(b) There is no problem of migration. Families generally live in the same village for generations, and do not even travel much from one locality to another.

(c) There is no actual poverty on Guam and no starvation.

(d) The population is more or less homogeneous and not a mixture of colors, stocks, and races.

Improved housing, better sanitation and improved general living conditions will naturally play an important role in the decline of tuberculosis morbidity and mortality.

But an effective tuberculosis control service program which would discover the active cases, isolate, hospitalize, treat, and rehabilitate the patient and promptly and continuously follow-up, supervise the contacts of active cases and the old and arrested cases, and which would teach the native population a proper understanding of the disease, would ultimately wipe out tuberculosis from Guam.

Research.—Complete records should be kept on various basic studies to be conducted. Judging from the European and some American experience, B. C. G. may prove an effective vaccine in tuberculosis control, but well-controlled and limited research studies with B. C. G. vaccine are necessary before definite conclusions can be reached as to its efficacy and before mass immunizations of all the negative reactors is attempted.

Cost.—It may be argued that since it is such a small island with less than 24,000 population, is it worth the cost and effort?

There is, of course, but one strong and affirmative answer. The cost is negligible when compared with results to be obtained. It also may be pointed out that in addition to the native population, there are troops and many white civilians on the island. The health of the Americans residing on Guam may be reflected by the health of the native population. Disease knows no boundaries or color lines.

SUMMARY

1. The tuberculosis problem on Guam is presented.
2. Two tuberculin patch test studies are outlined.
3. A tuberculosis control service program for the eradication of the disease is suggested.

REFERENCES

1. SIMMONS, J. S., and others: *Global Epidemiology*. J. B. Lippincott Co., Philadelphia, Pa., 1944.
2. MEDLAR, E. M.: A pathologist looks at tuberculosis. *Bull. Nat. Tuberc. Assn.* **33**: 5-6 and 15, Jan. 1947.
3. OPIE, E. L.; MCPHEDRAN, F. M.; and PUTNAM, P.: Relative frequency of clinically manifest tuberculosis, open tuberculosis, asymptomatic lesions and deaths in white and Negro persons. *Amer. J. Hyg.* **23**: 530-538, May 1936.
4. EDWARDS, H. R.: Tuberculosis case-findings; studies in mass surveys. *Amer. Rev. Tuberc. (supp.)* **41**: 3-159, June 1940.

5. TURNBULL, R. B.; FARRIS, W. B.; and PATTERSON, M.: Tuberculosis case finding with mobile photo-roentgenographic unit in Sumner County, Tenn. *Amer. J. Pub. Health* **36**: 110-118, Feb. 1946.
6. SOPER, W. B., and WILSON, J. L.: Seven years' experience in roentgenographic and tuberculin detection of pulmonary tuberculosis among 10,633 students entering Yale University. *Tr. Am. Clin. & Climatol. A.* (1937) **53**: 15-27, 1939.
7. BOYNTON, R. E.; DIEHL, H. S.; and SHEPARD, C. E.: Relative value of fluoro-scopic, roentgenographic, and physical examinations in tuberculosis case-finding program in university students. *Am. Rev. Tuberc.* **37**: 49-56, Jan. 1938.
8. Editorial: *New York Med.* **3**: 15, Aug. 20, 1947. Quoted by HOLM, J.: Tuberculosis in Europe. *Am. Rev. Tuberc.* **57**: 115-128, Feb. 1948.
9. BLOCH, R. G.; FRANCIS, B. F.; EISELE, C. W.; and MASON, E. W.: Roentgenological group examinations for pulmonary tuberculosis. *Am. Rev. Tuberc.* **37**: 174-199, Feb. 1938.

ACKNOWLEDGMENT.—The author wishes to express his appreciation and thanks to Edward M. Banks, Pharmacist's Mate, second class, USNR; James MacFarlane, Pharmacist's Mate, first class, USNR; C. E. Miller, Pharmacist's Mate, second class, USNR; and the Commissioners and entire native population of Guam for their aid and cooperation in this study.



VENEREAL DISEASE AMONG NAVAL PRISONERS

LAWRENCE Z. FREEDMAN

Lieutenant, junior grade (MC) U. S. N. R.¹

IT HAS been a common observation among syphilologists, psychiatrists, and others interested in social hygiene that promiscuity and, associated with this, a relatively high venereal disease rate are often found among those with personality inadequacies (1) (2) (3) (4) (6). Mental subnormality is very commonly characteristic of them (4) (5) (6). For example, a group of sexually delinquent adolescent girls was found to have intelligence quotients ranging from 50 to 90 (7). Similarly, many studies have shown that psychoneuroses and specific neurotic stigmata are significantly higher in those who had been infected with one or another venereal disease than in comparable control groups. Altus (8), citing evidence that enuresis "is a general if not invariable indicator of psychoneurosis or psychoneurotic tendencies," found that enuretic, illiterate soldiers had more frequently been infected with venereal disease than a comparable nonenuretic group.

A very interesting and complete study by Wittkower and Cowan (6) on the psychological aspects of sexual promiscuity disclosed that the most frequent precipitating factor found in interviews with venereally infected service personnel was "service maladaptation." Fifty-eight percent of these men complained of "marked dislike and incompetence for job, social isolation of unit, resentment of stern discipline, lack of social facilities, demotion, etc." More than half of these men were classed as "discontented" with army life while less than one-third of a control group made such complaints. Most striking, especially in the light of our figures, was the fact that 20 percent of the venereally infected men had been convicted of moderate to serious army crimes. Only 8 percent of the control group had ever been convicted of such crimes. The Gluecks (9) reported that in their series one-quarter of the men admitted to the Massachusetts Reformatory were suffering from venereal disease when they were admitted.

¹ Inactive.

In addition to this correlation between promiscuity, venereal disease, and personality disorders, many excellent studies have shown a high incidence of manifest psychiatric disabilities in those who have displayed aberrant social behavior sufficiently serious to be classified as crimes. Especially pertinent to our study are the results of the extensive observations made on 24,000 military prisoners by MacCormick and Evjen (10). They found that in this large group only 14 percent were free from personality disorders or mental deficiencies.

PROCEDURE

The present observations were made when the writer served as medical officer, and later as neuropsychiatrist at the United States Disciplinary Barracks, Norfolk, Va. A statistical analysis was made of the incidence of venereal disease among all prisoners who had committed crimes for which they had received a general court martial. The majority of these had either deserted or had been guilty of repeated offenses in which they failed to return from leaves, or had left their station without permission. A few had committed such crimes as theft and assault, and there was one murderer in the group. A small number had been imprisoned for sexual perversions.

The total number of personnel studied was 1,187. Nine hundred and twenty-seven of these were prisoners. In this group 123 or 10.3 percent were Negroes, and the remaining 804 or 89.7 percent were white. For purposes of comparison a similar analysis was made of the regular naval and marine personnel assigned to the disciplinary barracks. These numbered 260, and consisted of naval personnel and marines assigned to guarding the prisoners. They were all white. (See table 1.)

The diseases which were included in our study were gonorrhea, syphilis, chancroid, chancroidal lymphadenitis, and lymphogranuloma venereum.

TABLE 1.—*Number of subjects*

	<i>Number</i>
Total ship's company.....	260
Total prisoners	927
Total colored prisoners.....	¹ 123
Total white prisoners.....	² 804
Total personnel	1,187

¹ 10.3 percent of total prisoners.

² 89.7 percent of total prisoners.

The main purpose of this paper is to present the quite striking contrast between the two groups, prisoner and station personnel, in the frequency of infection.²

In addition to the venereal studies, all the prisoners had brief psychiatric interviews. The general conclusions reached are included with our results but any attempt at psychogenetic analyses of these is considered beyond the scope of this brief study.

RESULTS

VENEREAL INFECTION

Of the total number of prisoner personnel, 185 or 19.7 percent were found to have had venereal disease one or more times. In contrast to this, only 7 or 2.6 percent of our ship's company had a history of venereal disease. (See table 2.) There was also an interesting discrepancy between prisoner and nonprisoner personnel in the frequency of repeated infections. Thirty-three, or 22.7 percent of the white prisoner personnel, and 18 or 43.8 percent of the Negro personnel were infected from two to five times. (See fig. 1.) This incidence of repeaters is, of course, unusually high. None of the ship's company was infected more than once. (Care was taken to count as repeaters only successive, and not simultaneous, infections of different diseases.)

TABLE 2.—Frequency of infections in prisoners and ship's company

	Prisoners				Ship's company (white)	
	White		Negro		No.	Percent
	No.	Percent	No.	Percent		
Total infected.....	144	17.9	41	33.3	7	2.6
1 infection.....	111	77.3	23	56.2	7	100.0
2 infections.....	23	15.9	10	24.4		
3 infections.....	5	3.4	5	12.2		
4 infections.....	5	3.4	2	4.8		
5 infections.....	0		1	2.4		
Total personnel.....	804		123		260	

Of our 804 white prisoner personnel, as noted in figure 2, 144 or 17.9 percent had been infected with venereal disease during their naval service. One hundred and eleven or 77.3 percent were infected only once. Twenty-three or 22.7 percent were infected twice or more. Of these, 23 or 15.9 percent were infected twice, 5 or 3.4 percent were

² Because many of the prisoner personnel remained at this activity for only a few months, it was not practicable to compare hospital admissions per capita per year, as is usual among venereal epidemiologists. Instead, the incidence of venereal disease contracted at any time during the entire course of the enlisted man's service was tabulated. For this reason the excellent, extensive, statistical analyses of the venereal disease control units of the United States Navy are not referred to in this paper.

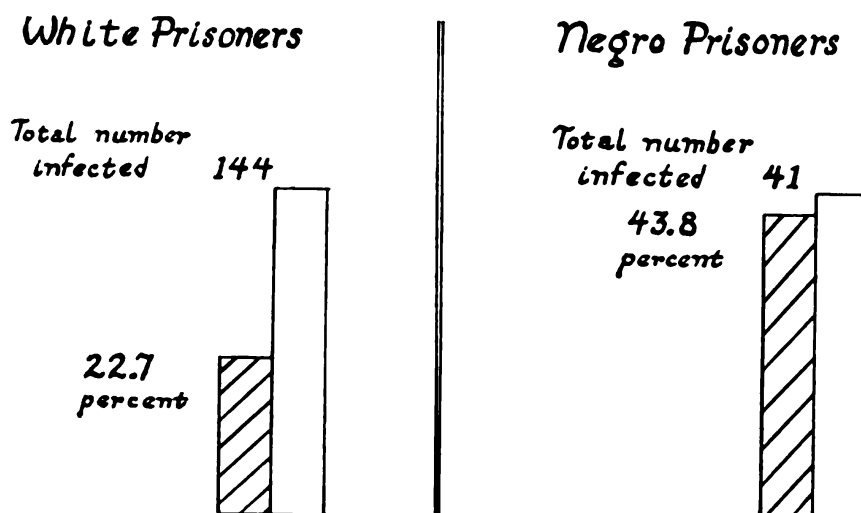


Figure 1.—Number of repeated infections in white and Negro prisoners.

infected three times, and 5 or 3.4 percent were infected four times. (See fig. 3.)

The incidence by disease was as follows: 100 had gonorrhea once, 18 were repeaters and had gonorrhea twice, 5 had the same disease three times, and 3 were infected with this disease four times. One man had gonorrhea, later contracted chancroid. Three men had had syphilis and at another time contracted gonorrhea. Two men were infected with gonorrhea three times and chancroid once. There were 8 cases of syphilis, and 1 case of syphilis followed at a later date by chancroidal lymphadenitis. There was only 1 report of lymphogranuloma venereum and 2 cases of chancroid.

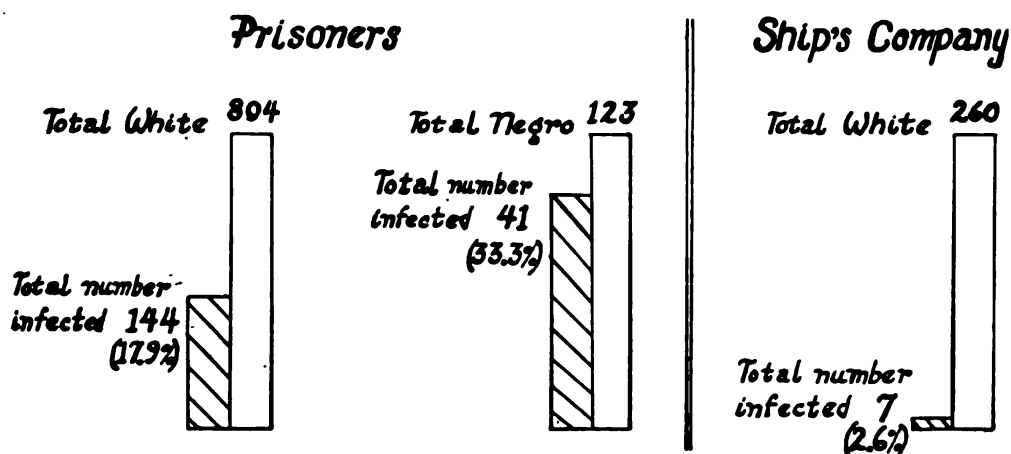


Figure 2.—Total infections in prisoners and ship's company.

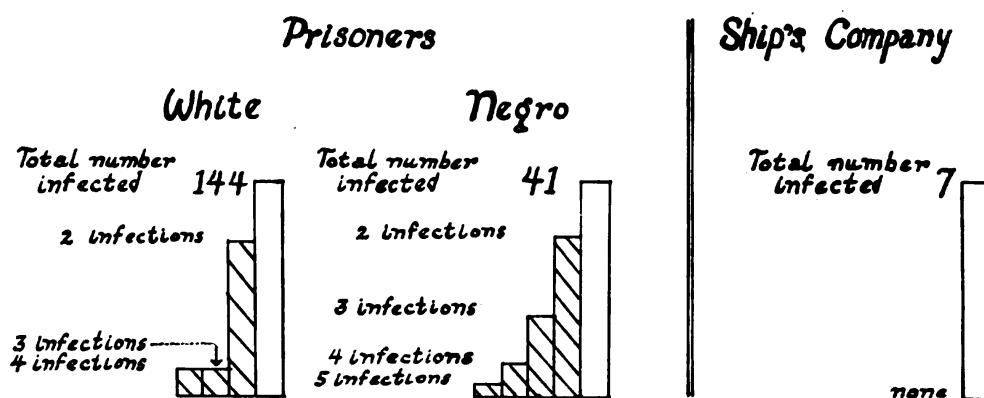


Figure 3.—Frequency of repeated infections in prisoners and ship's company.

Of the Negro prisoner personnel, as shown in the same tables and figures, out of 123, 41 or 33.3 percent were infected once or more. Of these, 23, or 56.2 percent, had venereal disease once. Ten, or 24.4 percent, had been infected venereally twice. Five, or 12.2 percent, had been infected three times, 2, or 4.8 percent, had been infected four times, and 1, or 2.4 percent, was infected five times. The incidence by diseases was as follows: 20, or 48.7 percent, had gonorrhea once, 5 had gonorrhea twice, 3 had gonorrhea three times, 4 had gonorrhea and syphilis once, 1 had gonorrhea three times and syphilis once, 1 had gonorrhea three times and lymphogranuloma once, and there were 3 cases of syphilis alone. One Mexican prison had gonorrhea once.

Our ship's company at that time consisted of 193 marines and 67 sailors, totaling 260. Of these, 7 had been venereally infected; 5 had had gonorrhea and 2, syphilis. There were no repeaters. This gives a venereal disease rate for the ship's company of 2.6 percent. This is in striking contrast with the percentage of venereal disease in prisoners as noted above.

PSYCHIATRIC INTERVIEWS

Of the white infected prisoners only four men had been referred to a psychiatrist previous to their offenses. Their diagnoses were, respectively, (1) inadequate personality, (1) homosexuality, (1) schizoid personality, and (1) dementia praecox. Three of these had gonorrhea and one had syphilis. There was no psychiatric diagnosis on any member of the ship's company previous to entering our barracks.

It is an interesting and perhaps significant fact that our venereal reports, routinely taken, indicate that these men were extremely lax in venereal disease prophylaxis. The overwhelming majority reported that they did not visit a health station or use any of the means of chemical or mechanical prophylaxis which were readily available, and with which they were well acquainted.

In our routine psychiatric interviews the developmental background in the majority of cases was found to show such factors as illegitimacy, broken homes, habitually drunken parents, and general insecurity, economic and social in origin. The most common commentary on these men was that their "judgment is poor and their behavior impulsive." Also, they were "emotionally immature and unstable," and their personalities were "poorly integrated and stabilized."

DISCUSSION

This short study confirms previous observations that there is a very real and significant relationship between general behavioral difficulties and the incidence of venereal disease. This association of personality disorders and venereal infection could not be mistaken.

Demonstrating this correlation does not, by any means, explain the relatively heavy venereal infection, but it raises interesting questions which, if pursued, may hold answers alike in the field of epidemiology and psychological medicine. We may justifiably expect that the cause for this unusually high incidence of venereal disease will be found to be intimately connected with the same impulsive, immature, emotionally labile personality which we have learned to expect in a large percentage of our socially maladjusted.

For effective and efficient preventive medicine, the problem of venereal disease cannot be approached solely as a medical problem. The psychiatrist and the sociologist are important as well as the internist and the genito-urinary specialist. As Dr. Thomas Parran (2) has pointed out, "we need to know more of man himself, his interpersonal relations, his sexual instincts, his ability to sublimate his most compelling appetite to keep it within social bounds, within the moral code. Research in these fields is no less necessary than in the medical."

SUMMARY

1. The study of the venereal history of white and Negro general court-martial prisoners as compared to white ship's company enlisted personnel was undertaken at a naval disciplinary barracks.
2. Seventeen and nine-tenths percent of the white and 33.3 percent of the Negro prisoners had had venereal infection during their period of service. Only 2.6 percent of the white ship's company personnel had been venereally infected.
3. Forty-three and eight-tenths percent of the Negro prisoners, and 22.7 percent of the white prisoners had had repeated infections. None of the ship's company had more than one infection.
4. The majority of the prisoner personnel were described by the psychiatrist as having personality inadequacies.
5. The psychiatric aspects of venereal epidemiology are pointed out.

REFERENCES

1. United States Federal Security Agency, Community War Services Office : Challenge to Community Action. Washington, D. C., 1945, p. 75.
2. PARRAN, T.: New strategy against venereal disease. *J. Social Hyg.* **32**: 127-134, Mar. 1946.
3. STERNBERG, T. H., and LARIMORE, G. W.: Army contribution to postwar venereal disease control planning. *J. A. M. A.* **127**: 209-212, Jan. 27, 1945; also *J. Social Hyg.* **31**: 26-33, Jan. 1945.
4. FESSLER, A.: Sociological and psychological factors in venereal disease. *Brit. J. Ven. Dis.* **22**: 21-28, Mar. 1946.
5. RACHLIN, H. L.: Sociologic analysis of 304 female patients admitted to Midwestern Medical Center, St. Louis, Mo. *J. Ven. Dis. Inform.* **25**: 265-271, Sept. 1944.
6. WITTKOWER, E. D., and COWAN, J.: Some psychological aspects of sex promiscuity; summary of investigation. *Psychosom. Med.* **6**: 287-294, Oct. 1944.
7. ABEL, T. M., and KINDER, E. F.: *The Subnormal Adolescent Girl*. Columbia University Press, New York, N. Y., 1942.
8. ALTUS, W. D.: Some correlates of enuresis among illiterate soldiers. *J. Consulting Psychol.* **10**: 246-259, 1946.
9. GLUECK, S., and GLUECK, E.: *Criminal Careers in Retrospect*. Harvard Law School Studies in Criminology. Commonwealth Fund, New York, N. Y., 1943.
10. MACCORMICK, A. H., and EVJEN, V. C.: Statistical study of 24,000 military prisoners, *Federal Probation* **10**: 6-11, 1946.



PRIMARY SPLENIC NEUTROPENIA WITH CONCOMITANT LYMPH NODE CHANGES

LUTHER G. BELL
Captain (MC) U. S. N.

and

ROBERT L. FLECK
Lieutenant (MC) U. S. N.

SPLENOMEGALY has long been associated with a disturbance of the balance of the circulating elements of the peripheral blood. In 1939, Wiseman and Doan published a preliminary report (1) followed later by a detailed report (2) of primary splenic neutropenia. Other authors (3) (4) (5) (6) have published similar cases, using the same terminology. These cases were all characterized by profound neutropenia, hyperplastic bone marrow, and splenomegaly. The presence of anemia and thrombopenia were variable. All were markedly improved or cured by splenectomy.

In May 1947, Hattersley (7) reported a case not cured by splenectomy. His case showed a marked neutropenia with a hyperplastic bone marrow, but did not have splenomegaly. Moore and Bierbaum (3) reported one case with a hypoplastic bone marrow, and Langston et al. (6) reported a case with normal bone marrow. The values given in the latter instance, however, would indicate a mild myelocytic hyperplasia.

The mode of action of the splenic dysfunction in this disease is in dispute. Whether the spleen acts by forming a substance which inhibits the emission of cells from the marrow, or by abnormal phagocytosis or both is a matter for research study. It has been suggested that the primary pathology lies in the spleen and its removal results in a cure.

The onset of this disease is insidious. The patient usually first seeks medical aid because of an acute infectious episode. The syndrome of fatigue, malaise, weight loss, and recurrent infections is present. Blood studies reveal a leukopenia and neutropenia with or without anemia or thrombopenia. Thrombopenia, when present, may be accompanied by bleeding tendencies. Sternal marrow studies show hyperplasia of the myeloid elements with the absence of abnormal cell forms. Splenomegaly is present. The adrenalin test as outlined by Doan and Wright (8) may be of some aid in confirming the diagnosis.

Microscopic findings of the splenic tissue are somewhat variable. Wiseman and Doan (2) reported excessive phagocytosis as the only abnormal finding. One patient in their series had an accessory spleen. Rogers and Hall (4) also reported a case with an accessory spleen, but increased phagocytosis was not observed. Sinusoidal engorgement, connective tissue hyperplasia, fibrosis, and broadened capsule and septa are variable findings.

Lymphatic tissue may also show marked phagocytic activity and hyperplasia. Lymph node studies have not previously been reported but will be discussed in more detail later.

In considering other known diseases which may simulate primary splenic neutropenia, agranulocytic angina ranks foremost. Many of the reported cases were so diagnosed and treated as such, but the lack of a therapeutic response, the presence of an enlarged spleen and the finding of a hyperplastic bone marrow revealed the error. Other blood dyscrasias such as pernicious anemia, aplastic anemia, and the leukemias also give characteristic bone marrow changes which are not present in splenic neutropenia.

The causes of splenomegaly are many and may present quite a diagnostic problem. Banti's syndrome may be difficult to differentiate if leukopenia is marked and the differential diagnosis depends largely on determining the presence of cirrhosis. Chronic splenitis as associated with malaria, tuberculosis, brucellosis, or syphilis may also present a difficult problem. The differential diagnosis will depend on the history and on finding evidence of the specific disease elsewhere in the body.

Doan and Wright (8) have described an adrenalin test as a diagnostic aid. In this, a measured amount of adrenalin is injected and blood studies performed at intervals until the spleen has relaxed to its former size. In splenic neutropenia, they described a sustained elevation of neutrophils beyond the test period, while the other blood elements return to the base line level. In the case to be presented this sustained level was not as striking as anticipated from Doan's report.

The accepted treatment for this disease is splenectomy. Preoperative care and preparation are necessary as these patients are usually debilitated and frequently have a marked anemia. The surgical procedure itself may be complicated if thrombopenia is present. The presence of an accessory spleen may unexpectedly prolong the duration of the surgery.

There is usually an immediate postsurgical improvement of the patient's blood count, but on the third or fourth day a marked platelet rise frequently occurs. It may appear that this is due to the

removal of an inhibiting or destructive element by the splenectomy. Ungar (9) has shown the spleen to contain a substance related to the bleeding time, and Troland and Lee (10) and others (11) (12) have made splenic extracts that caused a marked reduction of platelets when injected into laboratory animals. However, Willinsky (13) and Dawbarn et al. (14) have shown that a marked platelet rise will frequently occur following any type of surgery or trauma.

CASE REPORT

A 26-year-old white male was admitted on 5 May 1947 complaining of pain in the right jaw. This was found to be caused by an alveolar abscess. He had had repeated similar episodes resulting in the extraction of several teeth. The patient dated his ill health to December 1944 when he had contracted pneumonia while in the Army. After several months in the hospital he was returned to duty, but had suffered recurrent attacks of weakness and seemed to have a perpetual cold. He had frequent epistaxis and bruised easily.

He was discharged from the Army on points, but his ill health persisted and he consulted several physicians. Occasional blood studies were made, but the first abnormal count, to his knowledge, was made in May 1947, leading to his admission to this hospital. Careful questioning as to treatments, habits, and occupation failed to reveal any possible cause for the leukopenia.

Physical examination revealed a palpable, tender swelling on the right mandible, and infected ulcerations of the gums. There was a generalized lymphadenopathy and the spleen was palpable 5 cm. below the costal margin. The Rumpke-Leeds test was positive. Blood studies showed a leukopenia, neutropenia, and a marked thrombocytopenia (table 1). The sternal marrow was found to be hyperplastic, but no abnormal cell forms were present (table 2). The adrenalin test was questionably positive (table 3). A biopsy of an axillary lymph node showed the follicles to be large with markedly hyperplastic germinal centers. Both lymphoblasts and reticulohistiocytic elements were increased. There were numerous large macrophages but no giant cells. Phagocytic activity was pronounced (fig. 1) and mitotic figures were numerous. The sinuses were moderately dilated and filled with lymphocytes.

The leukopenia and neutropenia became progressively more profound and the platelets alarmingly few. The bleeding time also increased steadily until the time of operation (table 4).

On 7 July 1947 a splenectomy was performed. The surgery was technically complicated, due to a tremendous "oozing" of blood from the cut surfaces. Hemostasis was accomplished by the use of oxycel. Postoperatively there was a prompt rise of the white cell and platelet count with corresponding decrease in the bleeding time. When the platelet count rose to over a million, heparin and dicoumarol therapy was instituted to control clotting and avoid thrombosis. However, on the tenth postoperative day the patient developed pain in the right groin and leg which subsided the next day. On the twelfth postoperative day he developed considerable abdominal cramping associated with a sharp rise in the leukocyte count. This episode was also short-lived, lasting one day, and the remainder of the convalescence was uneventful. A postoperative bone marrow study showed a complete return to normal (table 2).

TABLE 1

Hospital day	Red blood cells	Hemoglobin	White blood cells	Polymorpho-nuclears	Lymphocytes	Monocytes	Eosinophils	Platelets
1	4.1	11.5	3,000	540	600	1,700	120	35,000
8	4.6	12	2,300	322	920	897	115	29,600
21	4.5	12.5	1,700	170	629	731	136	22,500
43	4.4	13	2,800	420	812	1,260	150	34,200
51	4.9	13.5	2,400	188	902	840	336	5,000
56	4.6	13	2,150	408	882	567	231	5,000
63	5.2	14.5	3,100	744	558	1,519	155	25,000
63 ¹	5.3	13.5	5,550	1,328	2,120	1,780	279	35,000
63 ²	5.2	14	6,100	2,860	1,220	1,885	61	53,000
64	5.2	14.5	7,800	5,210	1,660	1,980	0	83,000
66	5.5	15	12,100	8,490	1,426	1,920	121	30,000
67	4.5	11.5	7,500	3,680	750	2,400	525	890,000
69	4.1	11	6,300	2,000	1,300	2,250	750	1,200,000
73	4	12	6,850	2,120	1,430	2,380	880	1,292,000
75	4.5	12.5	12,000	7,550	1,720	2,520	1,200	1,400,000
81	4.5	12.5	19,550	14,300	1,430	3,040	700	1,575,000
96	4.5	13.5	17,900	15,000	540	1,430	895	490,000
96 ²	4.5	13.5	9,000	4,680	1,350	1,530	1,350	160,500
122	4.4	12.5	6,100	3,650	670	1,080	550	290,000
197	4.5	13.5	4,250	1,020	1,060	1,080	380	265,500
250	5.2	14	8,850	2,832	3,363	1,500	708	312,000
301	4	11.5	14,400	10,370	2,600	1,008	268	216,000
301	4.5	13.5	8,750	3,273	3,500	1,400	437	216,000

¹ Splenectomy performed on sixty-third hospital day.² Patient discharged.

Differential counts are cells per cubic millimeter.

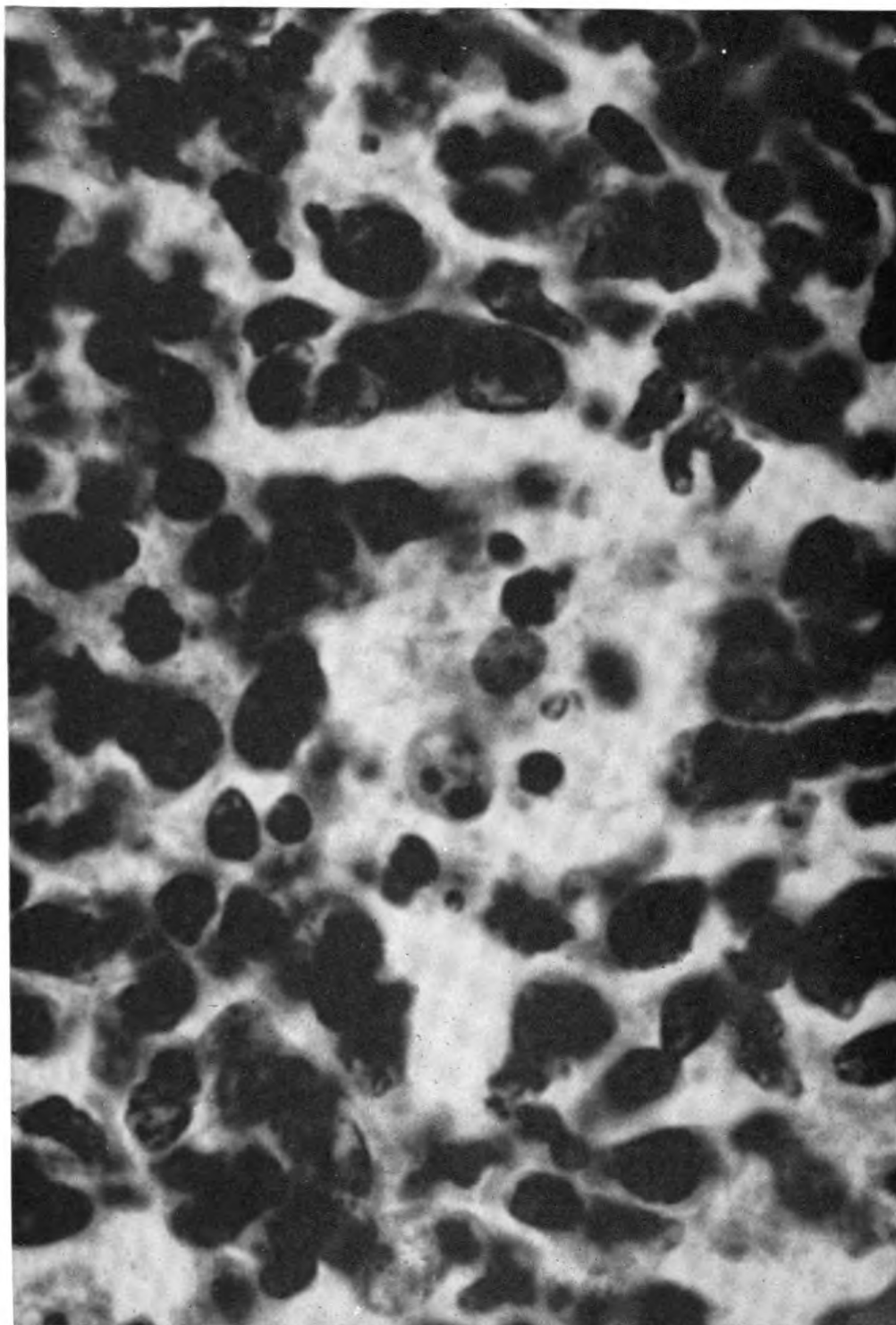


Figure 1.—Lymph node (preoperative) $\times 800$. Section through germinal center showing phagocytosis by large macrophages.

TABLE 2.—*Bone marrow findings*

Cell forms	Normal range	Admission	Preoperative	Postoperative
Myeloblasts.....	0.5-5.....	1.8	0.8	2.7
Premyelocytes.....	1-8.....	9.9	5.2	6.6
Neutrophils:				
Myelocyte.....	8-20.....	18	19	19.6
Juvenile.....	10-25.....	22.8	21	22.2
Bands.....	5-15.....	22.5	29.4	14.5
Segmented.....	15-35.....	10.5	13.5	9.6
Eosinophils.....	1-7.....	6	5	4.9
Basophils.....	0.5-1.5.....	0.3	0.4	0.7
Lymphocytes.....	5-20.....	7.5	5.6	17.9
Monocytes.....	0.5-4.....	0.3	0.4	1.3
Megaloblasts.....	0-0.5.....	0.2	0	0.2
Erythroblasts.....	0.5-4.....	2	1.4	1.3
Pronormoblasts.....	1-8.....	3	1.4	3.4
Normoblasts.....	10-20.....	6.9	5	13
Myeloid to nucleated red cell ratio.....	3-6:1.....	8:1	12:1	5.2:1
Megakaryocytes.....		Normal	Normal	Normal
Fat.....	0.5-1.....	0.5	0	1
Plasma.....	45-55.....	65	57	48.5
Nucleated cells.....	2-4.....	5	2.5	2.5
Erythrocytes.....	42-50.....	29	40.5	48

TABLE 3.—*Adrenalin test*

Time (minutes)	Blood pressure	White blood cells	Polymorphonuclears	Lymphocytes	Monocytes	Eosinophils
0.....	124/80.....	2,000	302	760	729	229
15.....			Adrenalin subcutaneous 1 cc.			
25.....		5,040	705	2,570	1,411	250
30.....	130/68.....					
35.....		4,800	268	2,448	1,344	624
45.....	136/72.....					
50.....		4,700	658	2,021	1,551	282
60.....	138/70.....					
65.....		3,250	714	1,088	1,120	227
75.....	134/64.....					
85.....		2,100	598	630	672	189
90.....	124/68.....					
95.....		2,250	845	440	742	202

White blood cells—average of 2 counts.

Differentials—average of 300 cells (counts represent number of cells per cubic millimeter).

Pathological study of the spleen revealed its weight as 570 grams. The capsule was smooth and tight (fig. 2). The cut surface showed homogeneous reddish-brown background with myriads of translucent round gray areas (fig. 3) ranging from one to three millimeters in diameter scattered uniformly throughout the organ. The tissue was soft, but not friable. Microscopic study showed the architecture well preserved, but the malpighian bodies were markedly hyperplastic (fig. 4). The germinal centers were very hyperplastic showing striking phagocytic activity (fig. 5). The trabeculae and capsule were normal. There was moderate hyperplasia of

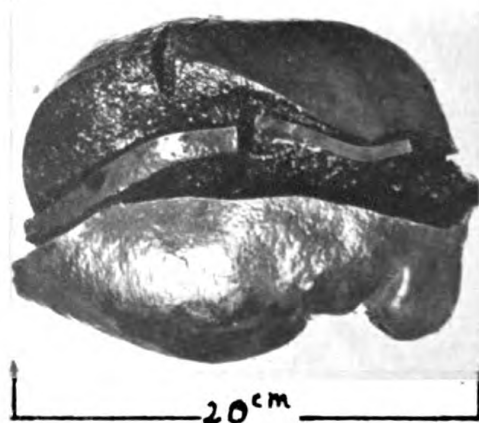


Figure 2.—Gross specimen of spleen showing increased size and smooth tight capsule.

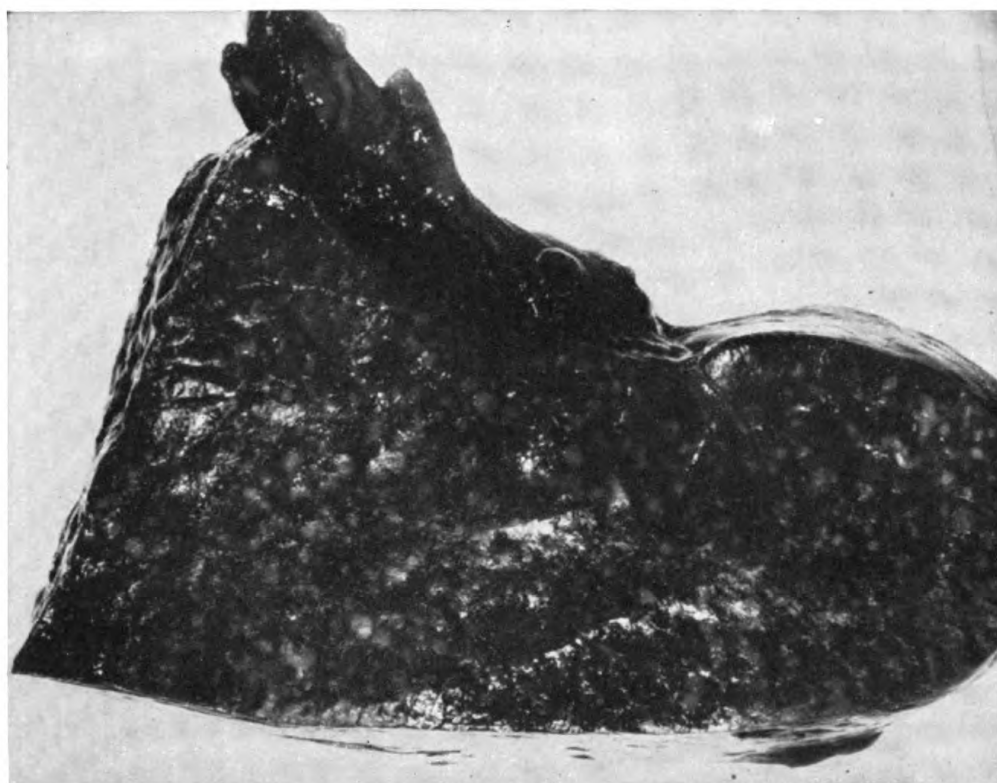


Figure 3.—Gross specimen of spleen. Cut surface showing myriads of translucent gray areas scattered throughout the organ representing areas of lymphoid hyperplasia.

the reticulohistiocytic cells. There was no evidence of hematopoiesis, but an increased number of megakaryocytes were present. The findings were strikingly similar to those observed in the preoperative lymph node biopsy.

The patient returned for follow-up studies periodically and on 24 November 1947 a second lymph node biopsy was obtained. This was similar to the previous node and spleen except possibly for some increase in activity. There was marked phagocytic activity (fig. 6), marked reticulo-endothelial cell hyperplasia and also some areas of increased fibrosis.

To date the patient remains asymptomatic and in good health. The blood counts, as shown in table 1, have remained essentially within normal limits.

DISCUSSION

This case very closely meets the criteria for diagnosis of primary splenic neutropenia as set forth by Wiseman and Doan (2). The patient had the typical onset of weakness, malaise, repeated infections, and weight loss. He had an enlarged spleen, purpura, and oral ulcerations. The bone marrow was hyperplastic for the myeloid series, but no abnormal cell forms were present. The blood showed a marked specific neutropenia associated with a thrombocytopenia but no anemia.

The involvement in this case was centered exclusively on the neutrophils and platelets. It is interesting to note that the progressive fall

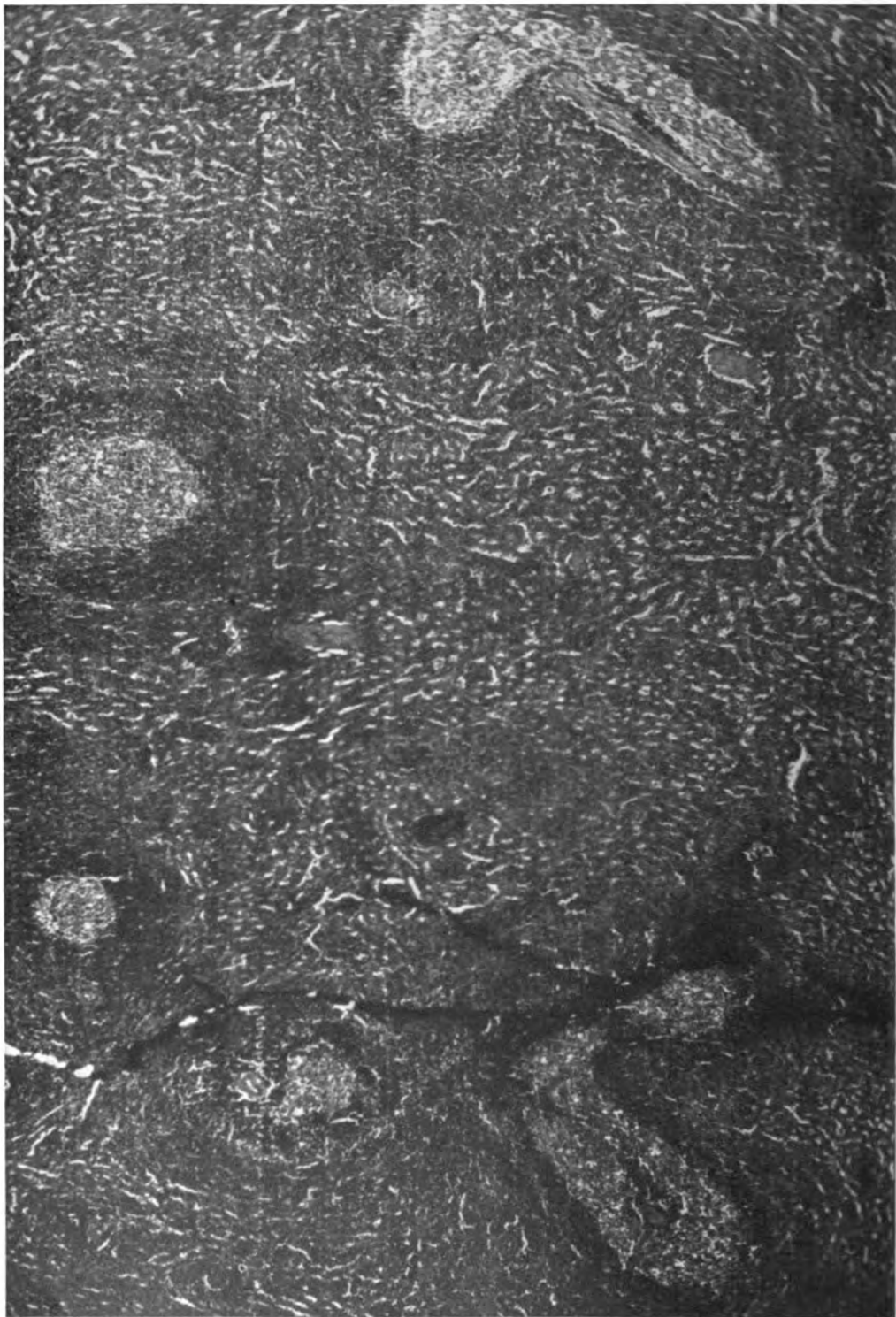


Figure 4.—Spleen $\times 60$. Section showing hyperplastic germinal centers surrounded by a thick layer of small lymphocytes.

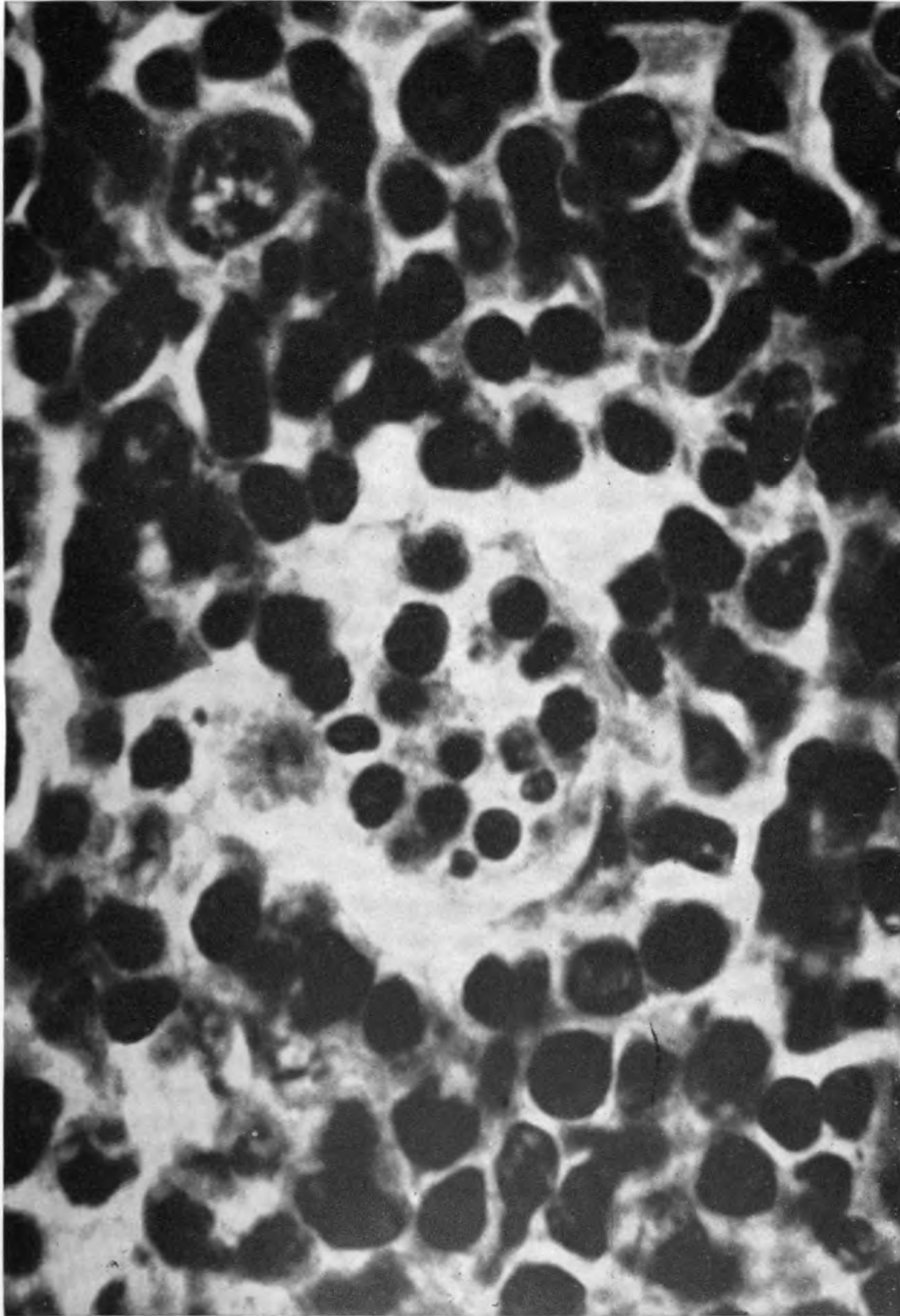


Figure 5.—Spleen $\times 800$. Section through germinal center showing phagocytic activity by reticulohistiocytic cells.

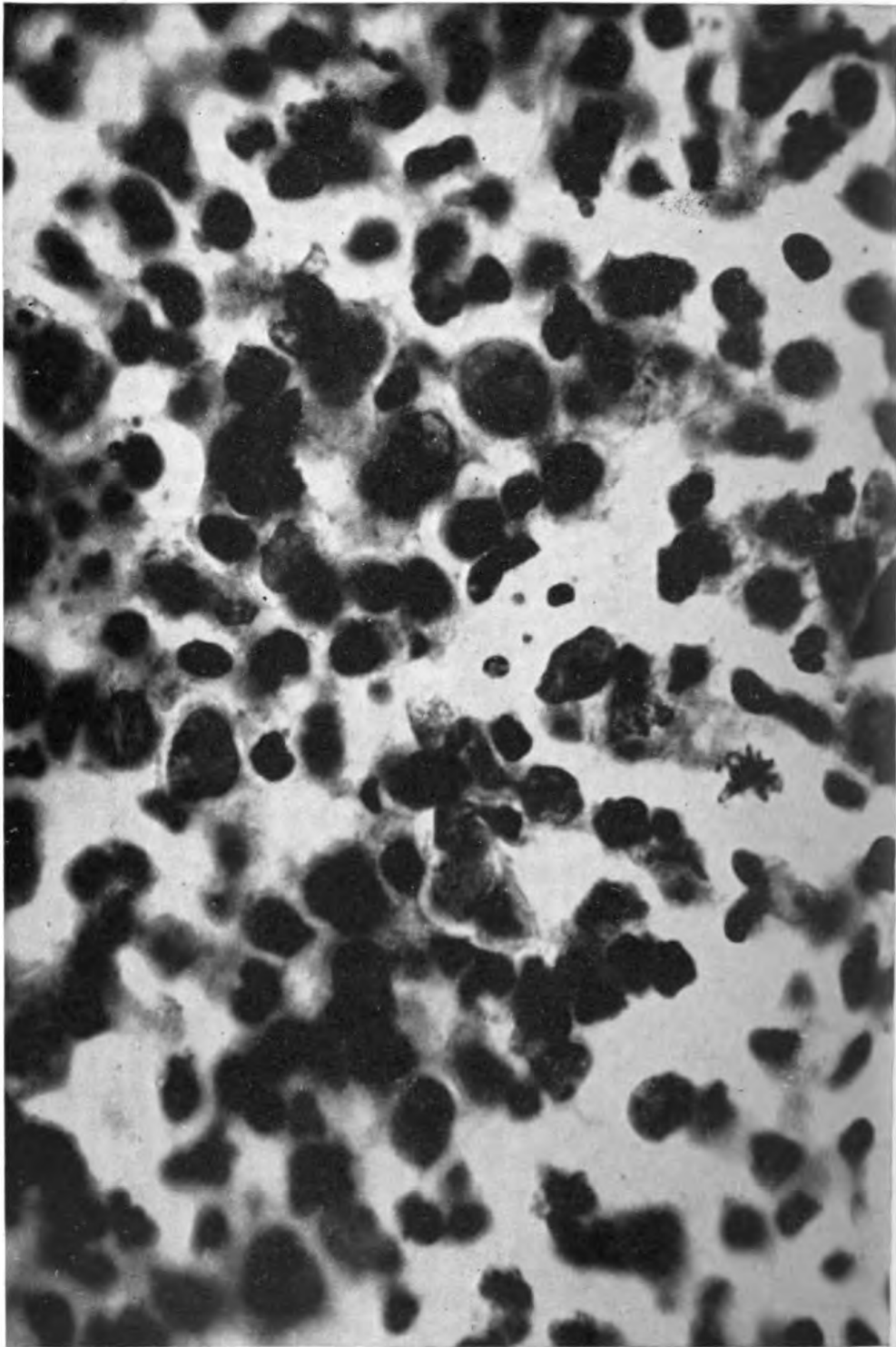


Figure 6.—Lymph node (postoperative) $\times 800$. Section through germinal center showing phagocytic macrophages and a mitotic figure.

in the platelet count prior to surgery was very closely related to the bleeding time. Also that the return to normal occurred in a matter of hours after splenectomy (table 4). This accounts for the profuse bleeding at surgery which was not from large vessels, but a seepage from the cut tissues themselves.

TABLE 4

Hospital day	Bleeding time	Coagulation time	Platelets
	<i>Hr. Min.</i>	<i>Hr. Min.</i>	
8.....	5 10	5 0	35,000
17.....	5 45	3 0	29,600
31.....	6 0	3 15	20,200
62.....	14 0	2 45	5,000
63 ¹ (1400).....	6 0	2 45	53,000
63 ¹ (2000).....	4 30	2 0	83,000
64.....	4 0	2 45	300,000
65.....	3 15	3 0	750,000
66.....	2 30	3 0	830,000

¹ Splenectomy.
Heparin and dicoumarol begun on 66th day (3d postoperative day).

The occurrence of the leg and abdominal pain was suggestive of a thrombotic process of the femoral and splenic veins, respectively. The episodes were very transient and passed without confirmation but were reflected in the white blood count on the twelfth postoperative day.

The adrenalin test was performed. (See table 3.) The neutrophils did maintain a slightly sustained level, but the most striking fact was their lack of a diphasic response as shown by the other blood elements. Attempts at finding a control were difficult as the test depends on the presence of an enlarged spleen. However, results from patients with splenomegaly of known causes (recurrent malaria and acute exacerbation of brucellosis) with a leukopenia showed very similar results. It is felt that this test may be of aid in diagnosing hypersplenism, but will not differentiate between the primary form and a secondary form of a known etiology.

The lymph nodes in this case showed excessive phagocytosis and hyperplasia. This may indicate that a disease process is in action that is directed toward the spleen and lymphatic tissue rather than originating in the spleen itself. This seems more evident in that the lymph node biopsy after splenectomy not only showed continued activity, but some increase in activity. If the source of pathology had been removed, the lymphatic system should have returned to normal. Lymphadenopathy has been a variable finding in the cases reported, but biopsy studies have not been published. The return to normal of the bone marrow would indicate that the source of the pathology had been removed, but it cannot yet be said that increasing lymphatic activity will not be reflected in the bone marrow in the future.

This may indicate a poorer prognosis than has been considered in the past. A further study of other cases by lymph node biopsy, as well as a prolonged follow-up in this case, will be necessary before such prognostication may be made.

The persistent monocytosis may be a significant finding. It at least raises the question of an early monocytic leukemia; however, four sternal aspirations, over a period of 11 months, have shown no evidence of a leukemia and would indicate the monocytosis to be a reflection of the generalized reticulo-endothelial hyperplasia.

SUMMARY

Primary splenic neutropenia has been discussed and a case reported. This case closely paralleled the others that have been reported. The results of the adrenalin test were not striking and not considered diagnostic. Lymph node biopsies before and after splenectomy were performed and discussed. It is suggested that a more careful observation be made of the lymphatic system in association with primary splenic neutropenia. It is felt that this may not only be of prognostic value, but may lead to further knowledge of the function of the spleen.

CONCLUSIONS

Primary splenic neutropenia is a disease of not only the spleen, but of the lymphatic tissue as well.

The adrenalin test is not diagnostic but may be of confirmatory value.

Splenectomy is indicated in this disease, but further study is necessary before it is considered a cure.

REFERENCES

1. WISEMAN, B. K., and DOAN, C. A.: A new recognized granulopenic syndrome caused by excessive splenic leukolysis and successfully treated by splenectomy. *Journal of Clinical Investigation* 18: 473, 1939.
2. WISEMAN, B. K., and DOAN, C. A.: Primary splenic neutropenia; newly recognized syndrome, closely related to congenital hemolytic icterus and essential thrombocytopenic purpura. *Ann. Int. Med.* 16: 1097-1117, June 1942.
3. MOORE, C. V., and BIERBAUM, O. S.: Chronic neutropenia treated by splenectomy. *Internat. Clin.* 3: 86-95, Sept. 1939.
4. ROGERS, H. M., and HALL, B. E.: Primary splenic neutropenia. *Arch. Int. Med.* 75: 192-196, Mar. 1945.
5. SALZER, M.; RANSOHOFF, J. L.; and BLATT, H.: Primary splenic neutropenia, with report of a case. *Ann. Int. Med.* 22: 271-273, Feb. 1945.
6. LANGSTON, W.; WHITE, O. A.; and ASHLEY, J. D., JR.: Splenic neutropenia; report of case with splenectomy. *Ann. Int. Med.*, 23: 667-672, Oct. 1945.
7. HATTERSLEY, P. G.: Chronic neutropenia; report of case not cured by splenectomy. *Blood* 2: 227-234, May 1947.

8. DOAN, C. A., and WRIGHT, C. S.: Primary congenital and secondary acquired splenic panhematopenia. *Blood* 1: 10-26, Jan. 1946.
9. UNGAR, G.: Endocrine function of spleen and its participation in the pituitary-adrenal response to stress. *Endocrinology* 37: 329-340, Nov. 1945.
10. TROLAND, C. E., and LEE, F. C.: Thrombocytopen; substance in extract from spleen of patients with idiopathic thrombocytopenic purpura that reduces number of blood platelets. *J.A.M.A.* 111: 221-226, July 1938.
11. CRONKITE, E. T.: Further studies of platelet reducing substances in splenic extracts. *Ann. Int. Med.* 20: 52-62, Jan. 1944.
12. HOBSON, F. C. G., and WITTS, L. J.: Platelet reducing extracts of spleen. *Brit. M. J.* 1: 50-51, Jan. 13, 1940.
13. WILLINSKY, B.: Note on changes in blood platelets after operation and injuries. *Lancet* 1: 1126-1127, May 24, 1930.
14. DAWBARN, R. Y.; EARLAM, F.; and EVANS, W. H.: Relation of blood platelets to thrombosis after operation and parturition. *J. Path. & Bact.* 31: 833-873, Oct. 1928.



HERPES ZOSTER FOLLOWING EXPOSURE TO VARICELLA; TREATMENT OF HERPES ZOSTER WITH COWPOX VACCINE

SAMUEL H. HORTON, JR.
Lieutenant Commander (MC) U. S. N.

THE possibility of a relationship between some cases of herpes zoster and varicella was first suggested to von Bókay (1) of Budapest in 1888 by his observation in two families of cases of varicella following cases of herpes zoster. He published the observation in 1892. Netter and Urbain (2) (3) (4) claimed that antigens prepared from the crusts of zoster or varicella lesions gave equally good complement fixation with serum from zoster or varicella convalescents. Kundratitz (5) found that whereas children who had neither varicella nor zoster could be inoculated cutaneously with zoster vesicle fluid, those who had had varicella were refractory. Siegl (6) reported the production of varicella in two out of six children, 22 to 23 days after cutaneous inoculation with zoster vesicle fluid. Roxburgh (7), after a review of the literature to 1927, concluded that at least some cases of zoster are due to the same virus as varicella. In 1937 Stern (8) arrived at the following interesting conclusions:

1. The eruption of herpes zoster is caused by infection passing from the sensory ganglion down the course of the sensory nerve of the skin.
2. Second attacks of herpes zoster are not uncommon.
3. The pain arises partly in the skin and partly in the deeper structure.
4. Herpes zoster and varicella are caused by the same infection.
5. Herpes zoster and varicella affect the same areas of the skin with equal frequency.
6. Of 31 successive cases of herpes zoster, 4 caused varicella in contacts.

Benjamin Sachs (9) reported on a child who developed herpes zoster and was allowed to remain in the general ward with no attempt at isolation. Twelve days later the occupant of a near-by bed developed a typical varicelliform eruption. This was followed by a mild epidemic in which three other wards were involved, on one of which every child with no previous history of varicella developed the dis-

ease. In none of the patients was there a history of herpes zoster. He recommended that each patient or attendant with zoster in a pediatric ward be isolated or removed from the ward at once.

Not all are in accord with this relationship between the two diseases. Cantor (10) stated that on Christmas Island in the Bering Strait herpes zoster was very common but varicella unknown, while on the mainland varicella was frequent. Several cases are on record in which a child who had varicella developed herpes zoster 4 to 6 weeks after recovery. It is difficult to explain this in a disease like varicella which usually produces a lifelong immunity, unless there are at least two different causes for herpes zoster. Dahl (11) reviewed the material from several Copenhagen hospitals including 1,401 varicella patients and 532 herpes zoster patients. He concluded from this study that varicella and herpes zoster diverge in age, sex, and seasonal distribution, and the epidemiologic data did not seem to indicate that the two diseases had a common etiology.

The facts *supporting* a relationship between the two diseases are:

1. Numerous cases have been reported where the two diseases existed simultaneously or followed each other in a few days.
2. In both varicella and zoster the identical lesions of malpighian bodies are found.
3. Kundratitz (5) found that children who had neither varicella nor zoster could be inoculated cutaneously with zoster vesicle fluid while those who had varicella were refractory.
4. Netter and Urbain (2) have shown that the antigen present in the crusts of varicella fixes the complement in contact with the serum of zoster, and inversely. The antigens are specific.

The facts *against* such a relationship are:

1. Varicella is definitely contagious; zoster may be only slightly so.
2. Varicella is rare in patients over 10 years of age while zoster attacks chiefly adults.
3. Zoster may be met with in patients who have had varicella.
4. The eruption does not always present the same appearance in the two conditions.
5. There may be a meningeal reaction in zoster which is rare in varicella.
6. In zoster there is not found the leukopenia with mononucleosis which may be present in varicella.

VARICELLA

Recently the writer had occasion to see cases of herpes zoster closely follow varicella on the same ship, a navy cruiser. All cases of varicella were in steward's mates who, by nature of their duties, were at least in casual contact with most of the crew.

CASE REPORTS

Case 1.—T. D. G., CST, USN, was seen at sick call aboard ship, complaining of a rash. Physical examination revealed unilocular vesicles on an erythematous base located on the face, abdomen, and back. Further examination was negative except for a mild pharyngitis and temperature of 99° F. A diagnosis of varicella was made and he was transferred to the U. S. Naval Hospital, Philadelphia, Pa., on 4 February 1948, where the diagnosis was confirmed. Under symptomatic treatment he recovered rapidly and was returned to duty in 10 days.

Case 2.—L. B. B., StM2, USN, was seen at sick call aboard ship, complaining of general malaise and a rash. The rash appeared 24 hours previously although he had not felt well for several days. He worked with patient No. 1. Physical examination revealed typical varicelliform lesions on the face, abdomen, and legs. Except for a temperature of 99.5° F., the remainder of the examination was negative. He was transferred to the U. S. Naval Hospital, Philadelphia, Pa., on 19 February 1948 where diagnosis of varicella was confirmed. Under symptomatic therapy he recovered rapidly and returned to duty in 10 days.

Case 3.—L. (n) S., StM3, USN, cleaned the compartment where patient No. 2 bathed and changed clothes. He was seen at sick call aboard ship, complaining of a sore throat. Treatment was given, but the next day he awoke to find vesicles on the face, arms, and legs. Scabies was considered but the following day the vesicles had spread to involve the greater part of the body. A diagnosis of varicella was made and he was transferred on 27 February 1948 to the U. S. Naval Hospital, Philadelphia, Pa., where the diagnosis was confirmed. The physical examination revealed tense and flaccid unilocular vesicles on a slightly erythematous base over the face, arms, thighs, and abdomen. Some had desiccated and a few vesicles were present over the upper chest and back. Adenopathy was minimal and the temperature was 100° F. He improved rapidly under symptomatic treatment and returned to duty in 10 days.

HERPES ZOSTER

CASE REPORTS

Case 1.—On 26 February 1948, C. C. K., S1, USN, was seen in consultation at the U. S. Naval Hospital, Philadelphia, Pa., because of a rash on the body. He had been treated for scabies without results. Two weeks previously a "kernel" had appeared above the right inguinal ligament and was quite tender. One week later he awoke to find tense, painful vesicles over the lower back and extending downward over the right hip. The pain was of a burning nature and localized to the involved areas. He had never had varicella.

Physical examination revealed groups of tense vesicles on an erythematous base situated to the right of the twelfth thoracic vertebra. These vesicles extended laterally and downward across the upper margin of the right gluteal muscles. Some had desiccated with a tight brown crust and others were tear-drop clear. A diagnosis of herpes zoster was made and he was vaccinated with cowpox vaccine, no other treatment being used. The next day the remaining vesicles were desicating, the erythema less and he stated that the pain was greatly improved. Thereafter he reported daily for vaccinations, a total of four being given. At the end of that time there was no pain or erythema and several small crusts were loosening spontaneously. Each of the four vaccinations resulted in an "accelerated" reaction.

Case 2.—On 27 February 1948 E. (n) T., S1, USN, was seen in consultation at the U. S. Naval Hospital, Philadelphia, Pa., because of a rash on the body. He had been treated with a salve without results. About a week previously he awoke to find a painful vesicular rash over the lateral aspect of the left chest. There had been no prodromal symptoms. He had never had varicella.

Physical examination revealed linear grouped deep vesicles and papules on an erythematous base traversing the left ninth and tenth ribs laterally and following the course of the left ninth thoracic nerve. Moderate pressure over the area caused considerable pain. A diagnosis of herpes zoster was made and he was vaccinated with cowpox vaccine, no other treatment being used. The following day he reported intense pruritus and slight accentuation of the pain. The lesions were much less erythematous but still present. A total of five daily vaccinations was given with complete involution of all lesions. However, 2 days later he returned, stating he was unable to work because of the pain. The skin was normal on inspection, but pressure over the involved nerve caused considerable distress. The area was mapped out and treated with ethyl chloride spray. He returned 3 days later stating that the pain was still present, and ethyl chloride spray was used over the involved root ganglion without success. At present he is being treated with high doses of thiamine hydrochloride by mouth. All the vaccinations were recorded as "accelerated."

Case 3.—On 14 February 1948 G. L. T., CQM, USN, was seen in consultation at U. S. Naval Hospital, Philadelphia, because of a rash and pain and stiffness in the left shoulder. The stiffness had first appeared 2 days previously, and he thought it due to wearing a wool shirt. Shortly thereafter he noted a few vesicles on the neck over the fourth cervical vertebra. On the day he was seen at the hospital, he arose to find the left shoulder stiff and painful and groups of vesicles on erythematous bases over the left shoulder and lower neck. There was considerable pain and hyperesthesia of the left arm. There had been no similar attacks. There was no history of varicella as a child or any known contacts with varicella or zoster.

Physical examination revealed deep, tense vesicles surrounded by areas of erythema. The lesions extended from the fourth cervical vertebra downward and laterally across the left shoulder and ended above the left anterior axillary fold. A diagnosis of herpes zoster was made and after being vaccinated with cowpox vaccine he was told to return daily. No analgesic was given although the pain was moderately severe. The next day the vesicles were desiccating, the pain and erythema greatly reduced and the hyperesthesia of the left arm was minimal. Five vaccinations in 6 days were given, at the end of which time the skin was normal except for several dark brown, tight crusts which were loosening spontaneously at the edges. There was no pain or hyperesthesia but he stated that upon a full flexion of the left shoulder a mild stiffness was present. Three vaccinations were read as "accelerated" and two as "immune."

COMMENT: This patient is the only one of the three cases of herpes zoster who was not stationed aboard the aforementioned cruiser. However, the first patient knew him and had seen him aboard the cruiser. Therefore it is not unlikely he was also exposed to varicella as were the others.

SEARCH FOR OTHER CASES OF HERPES ZOSTER

Herpes zoster in the young adult is usually less severe than in the older age group. Through mildness of infection, indifference of the

patient or erroneous diagnosis, it was possible that other cases of zoster which had not been recognized were present aboard the cruiser. Through the courtesy of the ship's commanding officer a survey of the ship's company was conducted. Six hundred and fifty-one men were interviewed, the following mimeographed questionnaire being used:

Name----- Rate or Rank----- Age-----

1. Have you ever had chicken pox?

Yes ----- No ----- Uncertain-----

2. Have you ever had shingles (herpes zoster)?

Yes ----- No ----- Uncertain-----

3. Do you have any skin rash, pain in the back or side?

Yes ----- No -----

The extreme infectious nature of varicella was shown by the fact that 303 or 46 percent replied in the affirmative to the first question and 85 stated that they were uncertain. A negative answer was given by 263.

In answer to question No. 2 there were 562 who replied negatively, 75 were uncertain, and 14 replied in the affirmative. This latter group was closely questioned and all gave definite history of physical involvement strongly suggesting herpes zoster. Eight of these stated that they had had both varicella and zoster and six had experienced zoster but not varicella. These figures bear out the fact that both diseases can occur in the same patient and that zoster is not an obviously contagious disease.

In answer to the third question, 148 replied in the affirmative and 503 replied negatively. The great majority of the first group presented acne, seborrheic dermatitis or a dermatitis suggesting epidermophytoses of the feet, groin, or glabrous skin. A number complained of chronic vague pain in the back, chest or legs which did not suggest the premonitory signs of zoster. Six cases of contact dermatitis and one case of erythema gyratum perstans were noted. No further cases of zoster were found.

DISCUSSION OF TREATMENT

Many treatments of herpes zoster are mentioned in the literature and all have their advocates. The standard textbooks (12) (13) of dermatology mention infra-red light, thiamine hydrochloride injections, autohemotherapy, pituitrin, sodium iodide, and roentgenotherapy. Findley and Patzer (14) treated four cases of herpes zoster by

infiltration of the appropriate sympathetic ganglions with procaine hydrochloride. The results were excellent. Pacreau (15) treated 25 cases of zoster and varicella successfully with staphylococcus vaccine.

Cowpox vaccination is reported as the most effective treatment of recurrent herpes simplex (16) (17). Its use in the treatment of herpes zoster also appears to be fairly common practice among dermatologists. It is interesting to conjecture how its employment in treating zoster originated—whether by supposed analogy to its good effects in recurrent herpes simplex or by a state of mild confusion between the two diseases, or to the likely relationship between varicella and herpes zoster. It is unusual, however, that such a well-known and fairly current procedure as the use of cowpox vaccination in the treatment of zoster has received such scant attention in clinical reports or therapeutic texts. A careful review of the literature produced but one report of its use in the treatment of herpes zoster. Lillie (18) reported three cases of severe herpes zoster ophthalmicus so treated. Two had proved refractory to other modes of therapy but all responded to cowpox vaccinations. He vaccinated the patients every 3 to 7 days for a total of from 3 to 5 vaccinations. One had a primary "take." The remainder were read as "immune" or "accelerated." Pillsbury (19) in a complete article on the therapy of herpes zoster, did not mention cowpox vaccination.

Occasional dermatologic complications of cowpox vaccination have appeared in the literature. The most common is eczema vaccinatum (12). Kaposi's varicelliform disease also had been reported following vaccination but both diseases are usually seen in children or young adults with atopic eczema or neurodermatitis (12). That these complications are infrequent is borne out by Eichenlaub (20) who reported 1 case of generalized dermatitis in 10,000 vaccinations. Director (21) described 1 case of postvaccinial exanthem among 122,000 vaccinations. Bloch (22) found 123 regional or generalized eruptions following 500,000 vaccinations. Of these, 20 were erythema multiforme and 4 were erythema iris.

The most serious complication of vaccine therapy is encephalomyelitis. This happens infrequently, as shown by Swan (23) who reported 1 case of encephalomyelitis following 50,000 vaccinations. Fyfe and Fleming (24) reported 9 cases of encephalomyelitis following vaccination for smallpox in Fife, Switzerland, where 75,326 vaccinations were performed. In Bern, Switzerland, 119,989 vaccinations were carried out with but 4 cases of encephalitis or myelitis (25).

SUMMARY

Most authorities are now agreed that there is a correlation between the viruses which cause varicella and herpes zoster. The lack of a

laboratory animal susceptible to the zoster virus throws the burden of proof on clinical experience. Herpes zoster, especially in young adults, is usually a mild disease and often requires little treatment. However, the course can be materially shortened, the pain diminished and the vesicles desiccated by early therapy. Cowpox vaccine used daily of every second day for a total of two to five vaccinations admirably serves the purpose. Postvaccinial complication have been reported but are rare. Patients with atopic eczema, chronic urticaria, neurodermatitis, hay fever, or asthma probably should not be so treated since this group comprises the majority of cutaneous complications. The effectiveness of cowpox vaccine in the treatment of both recurrent herpes simplex and herpes zoster may shed some light on a closer etiological relationship between the two diseases.

CONCLUSIONS

1. Three cases of herpes zoster are reported following probable exposure to varicella.
2. It is now generally agreed that a definite correlation exists between the two diseases.
3. Cowpox vaccination given daily or every second day for a total of from two to five vaccinations is an effective treatment of herpes zoster. It materially diminishes pain, promotes desiccation, and lessens erythema.
4. As far as can be determined this method of therapy for zoster has been reported only once previously.
5. The complications of cowpox vaccinations are rare.

REFERENCES

1. von BÓKAY, J.: Über die Herpes-Zoster-Varizellen-Frage. *Jahrb. f. Kinderh.* 105: 8-23, 1924.
2. NETTER, A., and URBAIN, A.: Zonas varicelleux; anticorps varicelleux dans le sérum de sujets atteints de zona. *Comp. rend. Soc. de biol.* 90: 189-191, Feb. 1, 1924.
3. NETTER, A., and URBAIN, A.: Nouvelles recherches sur la déviation du complément dans le zona. L'antigène du zona n'exerce aucune action sur le sérum des sujets atteints d'herpes. *Compt. rend. Soc. de biol.* 90: 461-464, Feb. 29, 1924.
4. NETTER, A., and URBAIN, A.: Réaction de fixation dans un zona arsenical et dans deux zonas après injection de bismuit pathogénie. *Compt. rend. Soc. de biol.* 90: 997-1000, Apr. 18, 1924.
5. KUNDRATITZ, K.: Experimentelle Übertragung von Herpes Zoster auf den Menschen und die Beziehungen von Herpes Zoster zu Varicellen. *Monatschr. f. Kinderh.* 29: 516-523, Jan.-Feb. 1925.
6. SIEGL, J.: Zum ätiologischen Zusammenhang von Herpes zoster und Varizellen. *München. med. Wchnschr.* 74: 189-191, Feb. 4, 1927.
7. ROXBURGH, A. C.: Pathologic relationships of herpetic diseases from clinical standpoint. *Brit. J. Dermat.* 39: 13-26, Jan. 1927.

8. STERN, E. S.: Mechanism of herpes zoster and its relations to chickenpox. *Brit. J. Dermat.* 49: 263-271, June 1937.
9. SACHS, B. (Brooklyn): Small epidemic of varicella following exposure to herpes zoster. *Quart. Bull., Sea View Hosp.* 7: 77-78, Oct. 1941.
10. CANTOR, S. J.: Herpes and varicella. *Brit. M. J.* 2: 508, 1921.
11. DAHL, S.: Beitrag zum Studium der Epidemiologie des Herpes Zoster und der Varizellen. *Schweiz. med. Wchnschr.* 76: 343-346, Apr. 20, 1946.
12. BECKER, S. W., and OBERMAYER, M. E.: *Modern Dermatology and Syphilology*. 2d edition. J. B. Lippincott Company, Philadelphia, Pa., 1947.
13. ANDREWS, G. C.: *Diseases of the Skin for Practitioners and Students*. 3d edition. W. B. Saunders Company, Philadelphia, Pa., 1946.
14. FINDLEY, T., and PATZER, R.: Treatment of herpes zoster by paravertebral procaine block. *J.A.M.A.* 128: 1217-1219, Aug. 25, 1945.
15. PACREAU, F.: Staphylococcus vaccine in treatment of herpes zoster and varicella. (Paris Letter) *J.A.M.A.* 102: 1413, Apr. 28, 1934.
16. ANDERSON, N. P.: Erythema multiforme; its relationship to herpes simplex. *Arch. Dermat. & Syph.* 51: 10-16, Jan. 1945.
17. FOSTER, P. D., and ABSHIER, A. B.: Smallpox vaccine in treatment of recurrent herpes simplex. *Arch. Dermat. & Syph.* 36: 294-301, Aug. 1937.
18. LILLIE, W. I.: Treatment of herpes zoster ophthalmicus with smallpox vaccine. *New York State J. Med.* 43: 857-859, May 1, 1943.
19. PILLSBURY, D. M., and FONDE, G. H.: Treatment of herpes zoster. *M. Clin. North America.* 20: 239-251, July 1936.
20. EICHENLAUB, F. J.: Erythema multiforme complicating vaccination. *South. M. J.* 19: 186-188, Mar. 1926.
21. DIRECTOR, W.: Generalized vaccinia and vaccinia reaction. *U. S. Nav. M. Bull.* 42: 884-889, Apr. 1944.
22. BLOCH, E.: Postvaccinal eruptions. *Lancet.* 2: 504-507, Oct. 31, 1942.
23. SWAN, C.: Case of encephalo-myelitis following vaccination. *M. J. Australia.* 1: 152-154, Feb. 19, 1944.
24. FYFE, G. M., and FLEMING, J. B.: Encephalomyelitis following vaccination in Fife. *Brit. M. J.* 2: 671-674, Nov. 27, 1943.
25. Oesch, F.: Ueber die bei der Pocken-Schutzimpfung 1940 im Kanton Bern aufgetretenen Impfschäden. *Ann. paediat.* 160: 94-103, Jan.-Feb. 1943.



NAVAL MEDICAL HISTORY



A WARTIME LOG OF THE UNITED STATES NAVAL HOSPITAL SHIP *SOLACE* FROM JUNE 1943¹

Part II

EUGENE H. DRAKE
Captain (MC) U. S. N. R.

WILLIAM W. STRANGE
Captain (MC) U. S. N. R.

HOWARD B. SPRAGUE
Captain (MC) U. S. N. R.

and

ARTHUR P. McGINTY
Commander (MC) U. S. N. R.

The *Solace* was sent to the fuel docks at Pearl Harbor, then moved to another berth to take on supplies. She sailed 7 September.

After an uneventful voyage, which included another crossing of the International Date Line, we arrived at Eniwetok 14 September. In the oiler anchorage we found the U. S. Hospital Ship *Relief*. We took fuel aboard and were sent to anchor in a berth off Eniwetok Island, where we were shortly joined by the *Relief*. There was an exchange of visits between the two ships and from our friends of the *Relief*, who had been in the harbor nearly a week, we got the word. We might as well relax and take advantage of the local facilities for swimming, fishing, and other means of recreation, they said, for we were both going to be here for some time. Neither ship was listed to participate in the new action at Palau. The *Bountiful* and the *Samartian* were taking the work. With childlike faith, we accepted this news and prepared to make the best of it.

¹ This is a continuation of the wartime log of the United States Naval Hospital Ship *Solace* and really forms a sequel to the account by Commodore Richard A. Kern (MC) USNR and Capt. Melville J. Aston (MC) USN which was published in the November 1946, December 1946, January-February 1947, and March-April 1947 issues of the U. S. NAVAL MEDICAL BULLETIN. Part I appeared in the July-August 1948 number.

At 1100 on 18 September we received a message to get underway for Peleliu Island at once. In an hour we were at sea, skirting the reef and looking over the fantail at the gleaming white false prophet as she rode quietly at anchor in the lagoon. The *Relief* arrived at Peleliu 2 days after us.

The Palau Islands were sighted on the morning of 22 September. We approached Peleliu and entered the transport anchorage opposite the beach at the foot of Bloody Nose Ridge. The beachhead had been established by the First Marine Division a week before and the air field was in their hands. Fierce fighting was still in progress along the slopes of the ridge. Anguar Island, on which the 81st Army Division had landed, lay astern of us. The *Bountiful* and the *Samaritan* had departed and we were to load at once. In a period of 3 days we admitted 501 patients.

On 25 September the *Solace* was ordered to proceed to Noumea. With overcast skies, frequent squalls and gusty winds, we seemed to be on the edge of a storm area during all the voyage. There were many serious and critical cases; the medical department found use for all the time provided by the journey of nearly 3,500 miles. We arrived 3 October and were taken to the dock, where two military bands were waiting. The patients were transferred to Army hospitals and to Fleet Hospitals No. 105 and No. 107.

Noumea was a new port to some of the ship's company; to others it had been home for months on end. All hands enjoyed the old French city with its mixed native and French population, the unusual wooden cathedral, the leper colony, and old penal institution. The two Fleet hospitals had now been in commission for more than 2 years. We were struck with their fine appointments and excellent management.

The climate at Noumea in October is delightfully cool. We slept under blankets and enjoyed it after our sojourn in the Tropics.

The ship sailed for Peleliu Island at 0600 on 7 October.

At a medical staff conference 9 October, the problems posed by our recent load of patients were discussed in detail.

The *Solace* arrived in the transport area at Peleliu on 15 October. Fighting was still going on ashore on both islands. Our patients came aboard less rapidly, but a large percentage of them had suffered serious wounds. The enemy forces were subsisting for the most part in caves and the business of routing them out was costly. Several of the ship's officers were able to get ashore and visit the enlarged airfield and the Marine field hospitals. We continued to receive Army casualties from Anguar Island until it was finally secured. Army troops were also being put ashore on Peleliu to take over from the Marine Corps.

The *Solace*, following the usual custom, had been leaving the transport area an hour before sunset on a figured course which would keep

her out of the region of the beach till after sunrise the next morning. A message from the Army-staffed Hospital Ship *Comfort* was intercepted 24 October. This message stated that the *Comfort* was under enemy air attack. The *Solace* was kept in the protected ship area at Peleliu, blacked out like the rest, until 2400, when she sailed with 512 patients.

At 0600, 25 October, the *Solace* arrived at Kossol Roads and began to take on fuel from a fleet oiler. The *Bountiful*, many supply ships and tankers, and 25 sea planes were riding in the quiet roadstead. Two miles away lay huge, mountainous Babelthuap Island, an enemy military center. The fleet auxiliaries went nonchalantly about their individual business, apparently without thought that they were within easy artillery range of the Japanese. The *Solace* departed from Kossol Roads at 1030.

We were docked at Manus Island, Seeadler Harbor, Admiralties, 28 October. U. S. Navy Base Hospital No. 15 was now located on Manus Island. Our patients were transferred to Base No. 15 and the Army Station Hospital.

The patients that the ship had received during the Palau conquest were discussed at a medical staff conference. Summary of the two evacuations from that area showed that the *Solace* had admitted 1,035 patients, 826 of whom were wounded men. There had been 29 deaths aboard ship, a mortality rate of 2.8 percent of all patients and 3.5 percent of battle casualties. We had not been overwhelmed with the admission of a great number of patients at any time in the action but the casualties on these two runs had been as severe as any we had so far encountered. We admired, but not for the first time, the fortitude with which these Marine Corps and Army patients endured their severe wounds. How seldom did a single one of them complain or seem disturbed about his condition! Their courage and their implicit confidence in those who were caring for them were a great stimulus to all of us. Neither pain nor mortar shell wounds had disturbed the imperturbability and bravery that had made them the greatest fighting men in the world.

The First Marine Division, which had taken Peleliu, still included many old-timers and they were as salty as the sea. Such a man was brought aboard, his arm in temporary splints, his uniform torn and stiff with blood and the mud of Bloody Nose Ridge. While his clothing was being removed, he was asked if he had other injuries beside that to his arm. "Sir," he replied, "I have another bit of a wound, on the inboard slope of my starboard buttock."

The *Solace* arrived in the lagoon at Ulithi Atoll on 1 November and anchored off Pontagrass Island near the *Samaritan*. Here we were destined to remain for many weeks, acting as Station Ship and servicing the Fleet. It had been more than a year since the *Solace*

had served in such a capacity. For that period of time we had seen little of the Fleet. A brilliantly lighted hospital ship in wartime is a pariah, routed on courses away from the traveled sea lanes. As one task force after another visited Ulithi we became familiar with the lines of many ships and made the acquaintance of some of their officers.

Ulithi has a large lagoon with a reef which is broken at intervals by coral islands. At the northern anchorage, Mog Mog, the recreation island, follows Pontagras. Asor contained the Atoll Command, then comes Sorlen and next Falalop, site of the airfield. Fassarai Island to the southwest was used as a home for all the natives of the atoll. A repair base and anchorage at the southern extremity of the atoll were also in operation.

The medical staff of the *Solace* provided consultations for the forces ashore as well as for the Fleet. The eye, ear, nose and throat, dental, skin, laboratory and medical departments were particularly busy in this type of work. In-patients were admitted from units of the Third and Fifth Fleets during the Philippine campaign. The ship treated many more burus and medical cases during this period than we had cared for while engaged with the Marine Corps in amphibious operations. From 100 to 300 patients were usually under treatment. Those who would require prolonged hospitalization were evacuated. This was accomplished by air. The patients were flown to Base Hospital No. 15 at Manus Island on the first leg of their journey. The flight surgeon in charge personally reviewed each group of proposed evacuees with our staff and provided us with excellent service.

A week after our arrival Ulithi caught the tag end of a typhoon. The lagoon was an uneasy anchorage from which it was feared the ship might have to make an emergency exit. Small boating was forbidden for 4 days. The *Solace* rode out the choppy sea with little difficulty and no damage.

At the end of the month several small enemy submarines gained entrance to the lagoon and torpedoed a tanker, the *Mississinewa*, which caught fire and sank. The *Solace* received patients from this attack. Four of the enemy submarines were reported to have been sunk by depth charges. The body of a Japanese, a member of one of the crews, was brought to the ship for disposition.

Capt. William Winthrop Hall (MC) U. S. N., reported for duty as the new senior medical officer as relief for Captain Bennett 9 December. During Captain Bennett's management of the medical functions of the ship, the mission of the *Solace* had materially changed. Our part in amphibious warfare had required new policies for the staff. Captain Bennett had been quick to see ways in which the medical spaces could be rebuilt to increase the efficiency of our work, quick

as well to place such plans before the Bureau of Medicine and Surgery and, with approval, to see that the changes were properly made.

We recognized Captain Hall at once as a man of great ability and judgment. He had an answer to each problem that arose and usually he stated the reason for his decision. His extensive knowledge of medicine and chemistry was at once a stimulus to us and a fund of information which was invaluable in the care of the patients.

Thus 1944 came to a close with the *Solace* at anchor in the Tropics near the intersection of 140th meridian of E. longitude and 10° parallel of north latitude. During the year the ship had covered 57,956 miles and had admitted 5,438 patients. We had evacuated patients from amphibious operations at Roi, Namur, Eniwetok, Guam, Saipan, and the Palaus. We had served the Seventh Fleet in New Guinea and the Admiralties. The final 2 months of the year had been spent acting as hospital for the Fleet while it was taking part in the campaign to retake the Philippine Islands.

The *Solace* continued to act as station ship at Ulithi. Patients were brought by units of the Fleet. Some of the casualties had been caused by enemy suicide bomber attacks. Survivors of three destroyers lost in a typhoon in the South China Sea were admitted to the *Solace*.

The experiences of some of these men approached the incredible. One man went overboard without a life belt when his ship capsized. He came up within reach of a life raft. Another lad was on a raft with several companions when he became delirious and decided to wade ashore. The nearest land was several hundred miles away. He jumped overboard and was rescued by his companions but not before he was bitten by a shark. A large area of skin was avulsed from one side of his arm and forearm. On the other side of his arm were numerous parallel lacerations made by the shark's teeth. A short time later one of the men on the raft drank sea water. The victim of the shark stuck his fingers down his shipmate's throat in an effort to make him vomit the sea water. This effort resulted in severe bites on his fingers. When transferred from the *Solace*, the wounds caused by the shark bite and the human bite were healing satisfactorily.

On questioning these survivors, it was learned that, with the exception of the one man who had no life preserver of any kind, all wore kapok jackets. No man among the survivors had an inflatable-type belt.

LCI No. 600 hit a mine and the entire crew became our patients. This group included 13 men with compression fractures of the spine. There were also numerous fractures of the long bones. Fat embolism was shown by autopsy to be the cause of death of two of these men. A third man, with symptoms and signs of fat embolism, survived.

An ammunition ship which lay a mile astern of us suffered an underwater explosion and miraculously escaped with moderate hull damage and the loss of one man. We received patients from this disaster.

The first of the new type "O" blood was flown in to us during January. Our problem of donors for transfusion was thus settled. The blood never failed to arrive in good condition. Very few reactions followed its administration.

The *Samaritan* sailed 15 February. On 17 February the *Solace* succeeded in getting up her anchor which had been on bottom for 3½ months. At 1700 we were underway for Guam. The ship reached Apra Harbor, Guam, at 0800.

The *Solace* had brought to Guam a few patients who were considered unsuited for air transportation. These patients were transferred to Base Hospital No. 18. Our consignment of type "O" blood was received on board and the ship took her departure at 0800 on 21 February.

We arrived at Iwo Jima in the Volcano Islands at 1000 on 23 February, which was D-day plus 4. The voyage northward had been made in cold, overcast weather, and heavy clothing had been broken



Figure 1.—DuKW's and LCVP's awaiting their turn to unload wounded. Mount Suribachi in the distance. Iwo Jima Operation, 23 February 1945 (D-day plus 4).

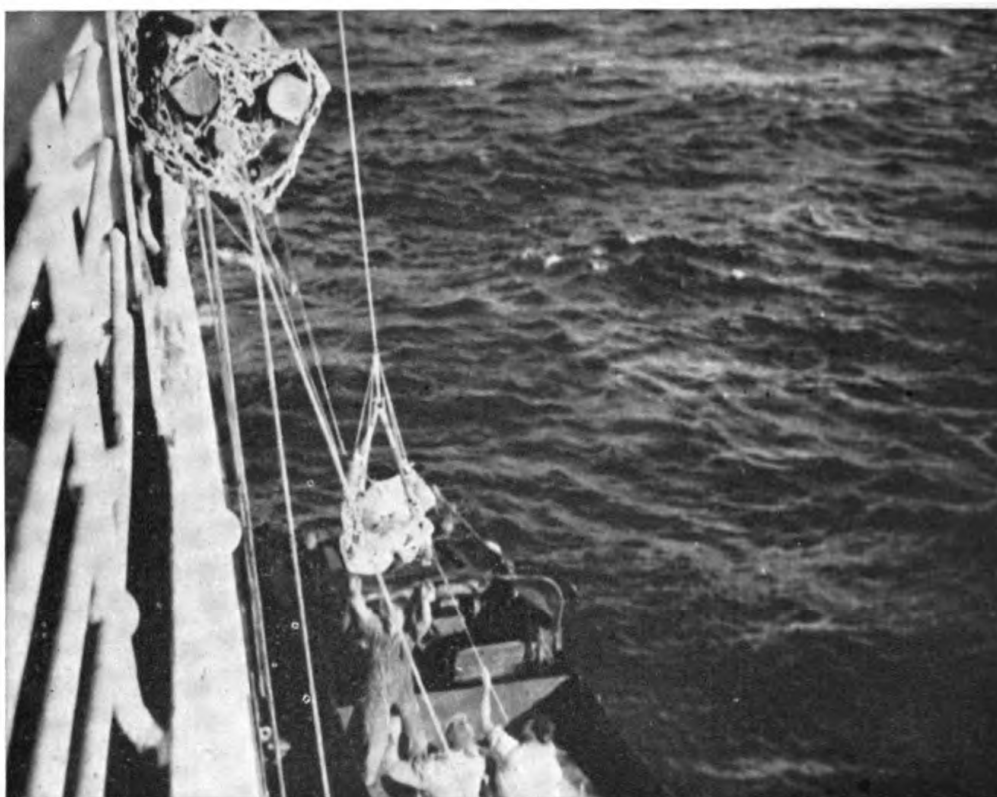


Figure 2.—Loading patients by boom and tackle in heavy weather.

out. The American flag was raised on the summit of Mount Suribachi the morning of our arrival. Cruisers, destroyers, and LCI's were still shelling the island. A heavy wind was blowing and there were 10-foot swells in the transport area. We began loading patients at once. Within an hour the starboard gangway was damaged by an LCM bringing wounded to the ship. The embarkation was continued by booms and hoist. As sunset approached the ship left the area on a course which passed the volcano Minami. We were back in the early morning. By midafternoon we had taken aboard 704 patients. Sixty-five of the less serious cases were sent to transports and cargo ships. The *Solace* sailed with a record load of 639 patients at 1800 on 24 February.

The trip to evacuate this load of patients lasted but 39 hours. Many of the patients had been aboard only 2 full days when they were put ashore. There were 28 patients with intra-abdominal injuries which demanded immediate treatment. In the allotted time the most urgent cases, including those with abdominal wounds, were operated upon. A mimeographed health record sheet was devised because there was not time for the Record Office to type records on so many patients; this sheet was filled out by the medical officer with indelible pencil and a carbon copy served as the ship's record. One hundred forty-six

blood transfusions were given; the largest number of transfusions on any previous run had been 112 at Eniwetok. There were 10 deaths, an over-all mortality rate of 1.4 percent.

The *Solace* reached Saipan 26 February and was docked in Tanapag Harbor at 1500. All the patients, only 189 of whom were ambulatory, were debarked in 2 hours. The Army Surgeon General Kirk and staff were present and came aboard the ship. The patients were sent to the Army General Hospitals Nos. 148, 176, and 369. At 1730 the *Solace* sailed again for Iwo Jima, which was reached 28 February.

The *Samaritan* was in process of loading and the *Solace* stood by throughout the day. Weather conditions were somewhat better, although it was still cold and the sea was choppy. We admitted 413 patients on 1 March. A total of 677 casualties had been received by the afternoon of 2 March and the ship sailed at 1735 with the largest number of patients ever evacuated.

The evacuation run on this second trip was to Guam, requiring 48 hours. There were 16 deaths. Two hundred eighty-six blood transfusions were given in a space of 4 days, another record for the ship. In the past operations we had been fighting a constant battle against dehydration, brought about in great part by the intense heat and high humidity. On the first two Iwo trips many patients were received aboard, shaking from the cold. It was necessary to keep supplies of hot coffee on the wards and in resuscitation rooms. Most of the men preferred the coffee to alcoholic stimulants.

The ship arrived off Apra Harbor by midafternoon 4 March. After a long wait for a pilot, she was taken into the harbor. Debarkation of patients began the next day at 0830 and at 1530 the ship was moved to the outer harbor; we sailed at 0800 on 6 March.

On 8 March we were back at the transport area, Iwo, and spent the day standing by. The *Samaritan* sailed at sunset. The next morning we were ordered to anchor near the beach. Loading conditions were much more favorable. At 1730, 10 March we sailed with 569 patients. There were 12 deaths on this evacuation. Two hundred forty-four blood transfusions were given.

During the three trips to Iwo Jima a total of 1,965 patients were carried with 38 deaths, a mortality of 1.9 percent if all patients were counted, 2.1 percent mortality among the wounded alone. There were five instances of gas bacillus infection; amputation was required in 4 cases. None of these patients died.

Many factors were combined to render the Iwo Jima offensive difficult for the *Solace*. Bad weather on the first two trips made loading difficult. The Third, Fourth, and Fifth Marine Divisions sustained many casualties and every available space on the *Solace* was utilized for patients on two of the runs. The return journeys were short and

there was not time enough to give definitive treatment to all the patients during the favorable period just after wounding.

There was a close similarity between all of the trips that the *Solace* made from Iwo Jima. As soon as we were anchored off the beach a constant stream of ducks, LCVP's, and LCM's came along side loaded with wounded who were embarked either by hoist or over the gang-plank, depending on the weather. At 1700, when it was necessary for the *Solace* to retire from the transport area for the night or to take departure for the Marianas with every available space filled, we would leave many boats loaded with wounded. These would be taken to transports.



Figure 3.—The oxygen man with portable equipment accompanies a chest case to the hospital ashore.

The *Solace* had bunks for 464 patients. During the Iwo campaign she carried 40 percent more than her complement. Cots were placed in the wards and on deck, and the crew was moved out of two of its compartments in order to use the bunks for patients.

As soon as the wounded began to come aboard work began for the medical department and continued, with few interruptions, until the end of the evacuation. Five operating tables were in almost constant use and many operations, which ordinarily would have been considered major ones, were done in the ward dressing rooms. In spite of all these facilities many cases had to wait for hours before

their turn came to be operated upon. It was necessary to assign priority to the most urgent cases. Many could not be given definitive treatment before the ship reached the Marianas and the patients were put ashore. On one of the evacuations it was found impossible to operate on any of the head injuries; there were too many intra-abdominal injuries which were given priority.

The work of the Nurse Corps and the Hospital Corps during this campaign was outstanding. Our hospital corpsmen have always worked hard and for long hours on amphibious operations and have rated high commendation on every evacuation run. Their services on this operation seemed especially well performed. Hospital corpsmen attached to various nonclinical activities, as for example the laboratory and x-ray department, put in the same long hours as the hospital corpsmen on the wards. The hospital corpsmen assigned to the various operating rooms did a particularly fine job.

At 0830 on 11 March we passed the *Bountiful* proceeding on a northerly course. The *Solace* reached Apra Harbor, Guam, 12 March at 1600. We were docked at 1830. Our patients were transferred to Base Hospital No. 18.

The action on Iwo Jima was drawing toward the finish and 5 days of availability were given the *Solace* for repairs which were accomplished by the ship's company.

The *Solace* left Guam at 1000 on 17 March and came to anchor in the lagoon at Ulithi the following day. The medical department was authorized to see patients in consultation but was ordered not to load in-patients. For this reason we were obliged to turn down our old friend, the *Hancock*, which came in with casualties after a "kamikaze" attack.

The *Solace* sailed from Ulithi 23 March, bound for the new landings in the Ryukyu Retto south of the Japanese mainland. This proved to be the first of seven trips which the ship made into this area.

The *Solace* entered the East China Sea on 27 March and at 1000 reached the Kerama Retto, which lies southwest of Okinawa. Landings were being made by Army troops on various islands in the group. Two anchorages and a sea plane base were being prepared. Enemy garrisons on the islands were small and resistance was not heavy. The islands were mountainous with terraced garden spots and the characteristic stunted hardwood trees, seen in Japanese pictures. Small villages could be made out on shore, the houses with red tile roofs. On the morning of the second day we anchored for the first time off Yokabi Island. Occasional boatloads of patients were brought for admission.

The *Solace* proceeded to Okinawa Island 1 April, which was L-day and Easter Sunday, and entered the transport area off Haguchi Beach on the west coast of the island. Landings were in progress, the

island was being bombed and shelled, but enemy resistance did not appear to be heavy and few patients were sent to the ship.

On 3 April the *Solace* was ordered to proceed to the Kerama Retto for the purpose of embarking patients. Enemy planes had been over the area each day and units of the Fleet had suffered damage. There were two transports in the Keramas which had been hit. On the shore at Yokabi Island was an APD which had been beached in a sinking condition. The remainder of the day was spent in loading patients. Shortly before sundown the *Solace* left on a retiring course in the East China Sea.

The next morning we reported to the Command at Okinawa and spent the day off Haguchi Beach. We had acquired 465 patients and were given orders to sail with this load at 0500 on 5 April.

Only 50 of these patients had been received from the beach at Okinawa. The remainder was nearly all Navy personnel among whom there was a high percentage of burns, some very serious. Sixty-seven and three-tenths percent of the traumatic cases had resulted from suicide dive-bomber attack. Eight deaths occurred during the evacuation, a mortality rate of 1.72 percent or, if the wounded alone are considered, 2.06 percent.

The *Solace* arrived at Guam at 1500 on 8 April. The ship was docked promptly and the patients disembarked.

The ship sailed for Okinawa at 1300 on 9 April. A message was received at 2300 directing us to Ulithi. We made the old, familiar lagoon at 1800, 10 April. For a few days there was opportunity to relax.

The *Solace* left Ulithi 15 April and arrived at Okinawa at 0800 on 19 April. It was necessary to visit the beach for medical purposes. First we made the Hospital LST 928 which was anchored near the shore with a pontoon barge alongside and was serving as receiving ship for the wounded. The LST 928 was also the Navy center for the distribution of blood. Here we secured passage on a duck which took us to Orange Beach 2, clambered in the best amphibian fashion up onto the shingle, and became an automobile. We visited the Tenth Army Command Post toward the east shore of the island and found the medical department set up in tents. The Army had been given the task of taking the southern part of the island and it was evident that the enemy had chosen this territory as the area they would defend. Kadena and Yontan airfields were in American hands and were being used by our planes. The Marine Corps had nearly reached the northern tip of the island. The Tenth Army encampment, as well as both airfields, was under sporadic fire from enemy heavy artillery.

From a medical standpoint the beachhead had been most satisfactory. No epidemic disease had appeared among the troops who then

had been ashore nearly 3 weeks. No malaria had been found, although the proper insect vectors were present. Some of the Okinawans had filariasis but no cases of schistosomiasis had been encountered. The reports of poisonous snakes on the island had apparently been exaggerated. There had been only four cases of snake-bite among the troops, none fatal.

The island was rather attractive. The country was rolling and there were many partly grown gardens. The houses had been badly damaged but most of the barns and other outbuildings were standing. Cows, horses, goats, and pigs wandered over the land. There was an abundance of fresh water and pasturage. Most of the farms had their own family burial vaults, dug into the side of a hill and made of cement. The farm buildings had protecting walls to shield them against the prevalent typhoons. We missed the coconut trees of the tropical islands.

The loading of patients on the *Solace* continued. An LST(H) coming along side with patients at noon 20 April rammed us and did minor damage to the superstructure.

We had run out of the area that night as usual and were proceeding with all lights operating. At 2130 the bridge sighted a plane believed to be hostile. At once there was a heavy nearby underwater explosion. The ship was severely rocked and shaken but we were still underway and thorough investigation showed no damage from the near-miss.

Embarkation of patients was completed 21 April and the *Solace* sailed for Guam at 1515 with 594 patients. She arrived and was docked at 1300, 25 April. All patients were transferred to Base Hospital No. 18. Although we had the usual percent of battle casualties on board, there had been only 1 death on this run.

The ship was kept in port for 2 days. She sailed for Okinawa at 1300 on 27 April. Word was received 29 April that the Navy Hospital Ship *Comfort*, staffed by Army Medical Corps officers and Army nurses, had been hit off Okinawa. Five doctors and six nurses had been killed and many others had been wounded.

On 30 April at 0100 a message from the *Comfort* was relayed to us. The *Comfort* was asking for surgeons, surgical instruments and supplies. The senior medical officer designated the two medical officers who were to go. The supplies and surgical instruments were assembled and packed. Then we stood by. At 0330 we met the *Comfort*, coming on a course opposite to ours. In answer to our message she replied that doctors and supplies were not needed. There was a considerable wind and a rough sea was running, so we were relieved to hear that the transfer did not have to be made in a whaleboat.

On 1 May a medical staff conference was held. The commanding officer addressed the staff on the subject "Abandon Ship." Members

of the medical staff discussed the following subjects: acute hepatitis; the care of patients with cord bladder, the management of head injuries; x-ray findings in gas bacillus infections; the treatment of burns; and autopsy findings in cases of severe burns.

The *Solace* arrived at Haguchi Beach at 1500, 1 May, and came to anchor. Our days of retiring from the transport area were over. We remained with the Fleet and sweated out the frequent air raids for the sake of the protection afforded us. This meant that the ship was blacked out. When an alert was sounded smoke boats started to produce a protective screen. This required that our blowers be shut off, otherwise there was soon a higher concentration of smoke within the ship than in the outside air. In a short time, air in the wards became very hot and humid. The fluid loss the patients suffered by sweating demanded constant attention. The medical department was directed to keep on with essential work in spite of General Quarters.

We learned at this time that the *Pinckney* had been hit by a suicide-diver bomber and that Capt. H. E. Stedman, the senior medical officer, and several others had been killed. It was recalled that Captain Stedman was a former member of the medical staff on the *Solace*.

The *Samaritan* was in the transport area and we were anchored near her. In the afternoon she was sent to the Kerama Retto for patients, while we continued to load the casualties that were brought from an LST (H).

There were three air raid alerts during the night. One is more or less like another, unless you are unfortunate enough to be hit. Announcement of approaching planes is made from the Command Ship. In a short time the whine of the smoke boats is heard and the acrid smell starts to filter into the ship. A deep, sepulchral voice says over the speaker system: "Set Condition One." There is a pause, broken only by the sound of the smoke boats. Suddenly the 5-inch and smaller guns of all the nearby ships crash into fire. Meanwhile you try to keep your mind on your work in the ward, the dressing room, or the operating room. Intervals of quiet are interspersed between burst of gunfire until the All Clear is announced: "Secure from Condition One."

The Hospital Ship *Mercy* arrived in the anchorage 2 May. Next day the *Samaritan* returned from Kerama Retto. On 4 May many of us saw the U. S. S. *Birmingham*, a mile away, hit by a kamikase plane during a daylight raid. The *Solace* received a large number of her casualties.

We had loaded 617 patients and at 0800 on 5 May the ship departed for Guam, accompanied for the first 24 hours by an APD escort. The following day a message was received diverting us to Tinian. On 7 May we passed the *Relief*, heading to the westward.

Two-thirds of the patients on this evacuation were relatively fresh casualties, admitted to the ship within 2 days of injury. Fifty-seven of the patients had been injured by suicide-dive bomber attacks. Included in this number were 43 burns. Autopsies performed on the four fatal burn cases disclosed toxic nephritis and marked necrosis of the liver. Three wounded men also died on the trip. The seven fatal cases makes a death rate of 1.38 percent of the injured and 1.13 percent of the total admissions.

All the burn cases were cared for in one ward, if possible. Pressure dressings were employed. Large amounts of dextrose, plasma, and serum albumin were given intravenously in the early treatment, with whole blood, amigen and sixth molar lactate as indicated. As our experience with burns increased we learned the necessity of giving larger quantities of fluids. The difficulty of keeping up the patients' fluid balance was undoubtedly aggravated by the heat of the Tropics. We realized our handicap in not having air-conditioned wards for the burn cases.

The *Solace* reached Tinian at 0830 on 9 May. Patients were transferred to Base Hospital No. 19. We left Tinian at 1130 to fuel at the transport anchorage, Saipan. Departure was taken for Okinawa at 1800.

Our escort was picked up at sea on 12 May and on 13 May we arrived off Haguchi Beach, Okinawa, at 1400. Patients were loaded during 14 May and throughout most of that night. With 601 patients aboard we were ordered to sail at 1000 on 15 May, followed by the faithful APD. The *Solace* arrived at Tinian at 0800 on 20 May and disembarked her patients.

As the ship was leaving the dock at noon, a steel towing cable from one of the tugs became wound about our portside shaft. Ernest Perez, S 1/c, a member of our crew, donned a diving apparatus and went down to try to free the cable. He fouled his airline over the cable. Lt. Fred Hall, our engineering officer, dove under the ship in a brave but unsuccessful attempt to free Perez. Perez was drowned and his body was not recovered. Divers, with equipment, were summoned and the cable was cut after some hours of work. A submarine alarm caused the closing of the nets and the ship remained at anchor in Tinian Harbor for the night.

The following morning the *Solace* proceeded to Saipan. A 4-day availability period was granted for necessary repairs to the ship's engines. The work was done by our own ship's company.

Five deaths had occurred on the fourth Okinawa evacuation, a mortality of 1 percent of all patients; of 0.83 percent of the traumatic cases alone. One hundred and fifty patients had received their injuries through enemy suicide-dive bomber action; many of them had come

from the U. S. S. *New Mexico* which was hit 12 May. There were 75 burn cases, with no fatalities. Only 39 percent of the wounded had been admitted to the ship within 48 hours of injury. Two of the patients who died suffered from severe intracranial wounds.

During the brief stay at Saipan, the facilities of the island were visited. There was a small but active hospital connected with the Naval Dispensary. Otherwise the military hospitals were Army institutions and were excellently maintained. Sick or injured natives were housed at the Military Government Hospital near Charan Kanoa.

The staff of that institution was made up of Navy medical officers. A number of interesting cases of tropical diseases were shown to us.

The necessary repairs to the ship were finished 25 May and we left for Okinawa for the fifth trip at 1700.

The *Solace* arrived at Okinawa on 29 May at 1400. The First and Sixth Marines were now fighting at the southern end of the island. Our lines extended nearly to Shuri Castle and Naha. Three Army field hospitals and two Marine Corps evacuation hospitals were functioning ashore. Enemy positions were being shelled by elements of the Fleet each day. There were daily enemy air raids over the anchorage and the picket lines.

During the remainder of 29 May and the next day, 585 patients were admitted to the ship. One-quarter of them were neuropsychiatric cases, and there were also 105 medical cases. Fifty-three and six-tenths percent of the traumatic cases had resulted from air attack but the wounded had nearly all been treated for several days on other ships. Seventy-two of these were burn cases and all did well. There was but a single death on the trip.

The *Solace* left Okinawa 31 May at 0900 and reached Guam 4 June. The ship sailed for the sixth trip to Okinawa at 1630 on 6 June.

A medical staff conference was held at 1300 on 9 June. Talks on the following subjects were given: appliances for jaw fractures, psychoneuroses of war, fragment wounds of head and abdomen, and an intrathoracic wound.

The *Solace* reached Okinawa at 1400 on 10 June. The Marines had captured both Shuri and Naha and the Army lines were being straightened to meet the Marines' advance on the west shore of Okinawa. Three battleships, four heavy cruisers, and two light cruisers were taking turns at shore bombardment. These ships were anchored about the *Solace* each night. Enemy air raids were becoming less frequent and were made with fewer planes. Our combat air patrol, formerly furnished by carriers, was now based on Okinawa airfields.

Shore medical installations were visited. There was a Navy blood distribution center ashore. The Third Corps Marine Evacuation Hospital was located near Yontan Airfield. The Second Corps Hospital

was situated farther south and inland. These hospitals were in tents with underground operating rooms and x-ray equipment. The air force was evacuating 400 to 600 patients daily.

Many of the patients were brought to us from Naha by LST (H)'s and even by combat ships. In 3 days we had loaded 604 patients, 125 of whom were psychiatric cases. Ninety-three and five-tenths percent of the traumatic cases suffered from bullet or shrapnel wounds. There were only 15 men who had been injured in suicide plane attacks. Eight patients died, a mortality of 1.32 or 1.91 percent of the 418 traumatic cases. With more recently wounded men to care for, there were two and one-half times as many major surgical procedures on this evacuation as on the previous trip. Two hundred and fifty-nine blood transfusions were given as against 138 on trip number five, and 244 units of plasma in contrast to 52 units on the previous evacuation. The higher mortality rate of trip number six was likewise due to the larger number of recently wounded men received.

Departure was taken for Guam at 0800 14 June. The ship was diverted to Tinian 16 June. We were docked and patients were transferred to Base Hospital No. 19 at 0800 on 18 June. The *Solace* then sailed for Saipan to fuel and arrived at 1600.

At 1700 on 19 June the *Solace* sailed on the seventh trip to Okinawa. Course was changed to the south at 1830 to search for survivors from a plane which was seen to crash in the sea. Neither survivors nor wreckage was discovered. The next day course was temporarily changed again because of the report that a typhoon was moving in a direction which would make it converge on our path. There were 2 days of wind and overcast skies, but the *Solace* escaped the typhoon.

A medical staff conference was held 22 June and the program consisted of talks on: An intraabdominal injury, a case of bacterial toxemia, pulmonary complications in a wounded man, and the choice of anesthetic in battle casualties.

The *Solace* reached the Okinawa anchorage at 1400 on 24 June. The bombardment group of ships was not to be seen. The enemy had been confined to three areas of ground near the southern point of the island. It was plain that the Okinawa campaign was nearing its end.

Medical officers from the *Solace* had an opportunity to visit the medical installations ashore at this time. An Army hospital visited was filled with wounded Japanese. The great majority of these wounded were in bad condition. We were told that many of them had been lying behind the lines for days, with little or no medical attention and that the Japanese had apparently run out of medical supplies. The day before our visit there had been 18 cases of tetanus among the wounded prisoners in this hospital; 14 died.

The frequent occurrence of tetanus among the Japanese was in marked contrast to the experience with our own wounded, none of

whom developed the disease. This was positive proof of the value of our tetanus prophylaxis.

Five hundred and thirty-seven patients were gradually loaded in the next 2 days. Only 6.5 percent of the patients were traumatic cases and more than half of these were suffering from old injuries. Two of the wounded men had died. Two other men died—both merchant seamen who died of peritonitis resulting from appendicitis. The over-all mortality rate was 0.57 percent and for the traumatic cases only 0.74 percent. Thirty-six casualties had resulted from kamikaze attacks.

During the entire Okinawa operation the *Solace* evacuated 4,009 patients with a total of 34 deaths. This gives a mortality rate of 0.84 percent, or, if traumatic cases alone are considered, of 1.07 percent. One-quarter of the deaths were due to severe burns, one-third to injuries resulting from suicide-dive bomber attacks. There were 9 cases of gas gangrene without a death. Twenty-two and five-tenths percent suffered from broken bones. Four hundred and seventy-seven major surgical operations were performed. One thousand and one hundred and seventy-three blood transfusions, 863 units of blood plasma, and 204 units of serum albumin were given.

The *Solace* sailed for Guam 27 June at 1000.

At 0100 on 1 July a message was received directing that only those patients who would be able to return to duty within 90 days were to be disembarked at Guam. The *Solace* arrived off Apra Harbor and was promptly docked at 0800, 1 July. Three hundred and fifteen patients were sent ashore. The remainder of the day was spent in cleaning the interior of the ship and in loading stores.

On 2 July, 222 cases for evacuation to Continental United States were received from the various hospitals on Guam. The ship sailed at 1300 with 444 patients.

We crossed the International Date Line at 1620 on 8 July. Sunday, 8 July was repeated.

Diamond Head was sighted during the forenoon of 11 July. The ship was made fast at Bishop's Point dock, Pearl Harbor, at 1340. Lying astern of the *Solace* was the U. S. S. *Tryon*, the ship which had relieved us. She was also loaded with patients for the United States. The new United States Navy Hospital Ship *Tranquillity* passed us outward bound at 1400. The U. S. S. *Haven* and U. S. S. *Benevolence* were also in port.

On 13 July the *Solace* shifted berth from Bishop's Point to X-ray anchorage where we were tied up to the *Haven*. The new, modern, Hospital Ships *Haven* and *Benevolence* were visited.

The *Solace*, homeward bound, sailed from Pearl Harbor for San Francisco at 0800 on 16 July. Purple Heart awards were made by the

commanding officer to patients 21 July. The ship arrived at San Francisco 22 July and moored at Pier 7 at 1137. Between 1200 and 1400 we transferred 424 patients. At 1500 we got underway to anchor at 1526 in anchorage 12, San Francisco Bay.

By the end of July, the *Solace* had spent 6 weeks as Station Ship in Ulithi, had made three evacuation trips to Iwo Jima during the assault on that island, seven trips to Okinawa under similar circumstances, and one trip to the Mainland with patients. She had escaped damage in an enemy air attack which took place while she was retiring alone from the forward area. She was present during many air raids on the transport anchorage at Okinawa and was unharmed. During the first 7 months of the year the *Solace* traveled 32,861 miles and admitted 6,824 patients.

At 1050 on 23 July 1945 the *Solace* got under way for Portland, Oreg., where she arrived 25 July. Preparations for overhaul were begun immediately. The ship was scheduled for complete overhaul and the installation of an air-conditioning system. On Tuesday, 14 August 1945, news of the final surrender of Japan came. This momentous event had its effect on the *Solace*. The installation of the air-conditioning system was canceled and plans for the overhaul were modified with availability until 12 September.

At the end of hostilities there were eight authorized engagement stars for the U. S. S. *Solace*. These were for (1) Pearl Harbor 7 December 1941; (2) Gilbert Islands Operation 24-26 November 1943; (3) occupation of Kwajalein and Majuro Atolls 3-4 February 1944; (4) capture and occupation of Saipan 18 June-2 July 1944; (5) capture and occupation of Guam 24 July-15 August 1944; (6) capture and occupation of Southern Palau Islands 6 September-October 1944; (7) Iwo Jima operation 23 February-10 March 1945; and (8) Okinawa Gunto operation 24 March-30 June 1945.

On 9 September Capt. Edward S. Lowe (MC) U. S. N. reported for duty as Senior Medical Officer as relief for Capt. W. W. Hall (MC) U. S. N. who was detached on 11 September.

On 11 September 1945, at an impressive ceremony on the bridge deck, the Navy Unit Commendation authorized by the Secretary of the Navy was presented to the *Solace*. This commendation was for "extremely meritorious service during the Japanese attack on Pearl Harbor, Territory of Hawaii, on September 7, 1941."

On 12 September the *Solace* departed Portland and arrived in San Francisco on 14 September. On 16 September the *Solace* took aboard 162 men, women, and children passengers. Many of these were residents of Hawaii who had spent the war years in the continental United States. The *Solace* sailed that afternoon.

The next few months the *Solace* was engaged in transporting service personnel and civilians between Honolulu and San Francisco. On her departure from Honolulu on 29 September she had 294 patients, but with each succeeding trip the patient load became much less and she carried civilian passengers.

The scenes aboard the old ship had changed markedly from those of a few months earlier. Instead of wounded men the wards and decks were crowded with women and children. There were dances and "happy hours" held on the bridge deck and on one occasion a USO troop presented a comedy for the passengers and crew. Several times we ran into rough weather and many of the passengers took to their bunks. At these times our corpsmen demonstrated their versatility and adaptability as they had during the war. It often fell to their lot to feed and care for the babies whose mothers were in no condition to take care of them. W. L. Leonard, Pharmacist's mate, second class, of Flushing, Long Island, proved so valuable in this work that at a "happy hour" Captain Peterson awarded him a citation and announced that he had been given a new rating, Baby Tender, 1st class.

On 10 November 1945, while under way, a dispatch stating that the designation number of the U. S. S. *Solace* had been changed from AH5 to APH15 was received; thus the *Solace* officially ceased to be a hospital ship. She continued on the "magic carpet" runs until after the beginning of the year 1947, when she was ordered to Norfolk, Virginia. There she was decommissioned on 27 March 1947.



THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



THE TEN GREATEST ADVANCES IN MEDICINE

Literary historians and critics are fond of such exercises as selecting the ten greatest novels, the six greatest poems, or the five greatest short stories. Historians engage in similar discussions as to the greatest military leaders or administrators. It is an interesting and not entirely unprofitable occupation for it does bring before us the greatest intellectual monuments that man has created, and more important still, it gives a true perspective of progress. This last is particularly the case with scientific or social advances.

The subject of the great discoveries in medicine has been somewhat neglected and it might be well to name those which could well be considered the ten most significant in the history of medicine. Naturally such selections are a matter of opinion and there will be disagreements as to single selections, or the reader may wish to compile a list of his own.

The following is one list that contains ten developments, any one of which would be difficult to do without in modern medical practice:

1. The Hippocratic Code of medical ethics.
2. The use of the ligature in the control of hemorrhage.
3. The discovery of cinchona, the first important specific in therapy.
4. Smallpox vaccination, which has saved more lives, prevented more blindness, disfigurement, and human misery than any other one medical discovery.
5. The bacterial origin of disease, the work of Pasteur and Koch.
6. The development of antiseptic and aseptic surgery (and obstetrics).
7. Discovery of the transmission of disease by insects or other animal vectors.
8. Discovery of general and local anesthesia.
9. Diphtheria antitoxin.
10. The x-ray.



WHAT MAKES A DISEASE IMPORTANT?

The leading article in the March-April 1948 number of the U. S. NAVAL MEDICAL BULLETIN deals with diseases of importance to the Navy. As the author points out, the first thing to consider is what criteria are we to use in reference to a disease. Is it the number of people afflicted by it, the number of deaths caused, or just what are we to consider the measure of importance? Thus, the common cold affects almost everyone at least once, usually twice a year, with a very low death rate. On the other hand, rabies, while an extremely rare condition, has a death rate of 100 percent, no case having been known to recover. Fractures of the leg are not general, but when they do occur, cause a long period of crippling and loss of working ability. Other diseases, such as infantile paralysis, may result in a more or less permanent disability for life. These different criteria, incidence, mortality, loss of working time, and permanent invalidism are well described by the author of this article.

This approach to the problem of disease statistics is interesting for, in general, all statistical information on disease gives incidence and mortality. During 1946, according to figures recently released, there were 98,033 deaths from accidents. The loss of time is not shown but is a matter of tremendous importance.

Another aspect is the amount of money spent for public health and collected by social agencies to combat certain diseases. It is difficult, probably impossible, to estimate accurately these amounts but some figures have been printed. In *Postgraduate Medicine* for September 1947, it is stated that only \$0.17 is spent on research for every death from circulatory disease, while \$2 is spent on cancer and \$500 for research in infantile paralysis.

It would seem that studies of disease from a number of viewpoints are indicated and that the epidemiologist and the statistician should develop new methods of presenting information, often of vital importance, in hospital planning, drug and appliance manufacture, research, and also, of course, to the physician who deals with the individual patient.



MEDICAL ETHNOLOGY AND THE NAVAL MEDICAL OFFICER

The study of the anatomical, biochemical, serological, and epidemiological differences in the various races of mankind is a fertile and not too well cultivated field of medical research. The Naval medical officer has peculiar opportunities for such studies and could make substantial contributions to this subject more readily than most medical men.

Anatomical and serological differences are particularly interesting and important, and careful measurements of such groups as the Polynesians in the Pacific Islands now under the trusteeship of the Navy could be made. The difference in susceptibility to disease in races is well known. Thus the Negro is relatively immune to malaria and yellow fever compared with the Caucasian. Larsen in Honolulu has drawn attention in his clinics to the relative incidence of deteriorative disease, arteriosclerosis, and apoplexy in the Chinese, Japanese, Hawaiian, and the white race. The influence of diet here is also a factor of interest. The incidence of tuberculosis in different races is well known. The causes of this and other racial reactions to disease and to climate are not fully known. Indeed, there are so many problems unsolved that there are few avenues of research more promising than those of medical ethnography and medical anthropology.



REACTIONS TO SUTURE MATERIAL

The sterility of suture material is always the first consideration and following this, the adequacy and integrity of the suture to coapt the tissues. Another matter, however, is the reaction of the tissue to the material itself. Toxic or irritative effects may result in tissue damage or proliferation.

Witter, in the *ARCHIVES OF SURGERY* for February 1948, gives his experience with the use of cotton sutures in 1,341 operations. About 3 percent showed reactions to these sutures. This reaction was, in general, a fibroplasia, sometimes resulting in considerable scar formation. In two cases in the series, the reaction was so severe as to threaten the life of the patient.

It is possible that the substance causing trouble is not the cotton itself but the chemicals used in the preparation of it for use. However, there is a suspicion that the cotton may act as a stimulant proliferation producing hormones. Witter makes a plea for a cotton suture prepared specially for surgical use and free, if possible, from any allergic-producing substance, and also for further study of the problem.

MEDICAL AND DENTAL OFFICERS

*Whose Deaths Have Been Reported Since
the Last Issue of the Bulletin*

LEUTSKER, ROY JOHN, Captain (MC) U. S. N. (Retired,
Inactive). Died 18 July 1948 at U. S. Naval Hospital,
San Diego, Calif.

SEBASTAIN, NEWTON LOOMIS, Lieutenant Commander (MC)
U. S. N. R. (Inactive). Died 7 May 1948 at Memorial
Hospital, Gulfport, Miss.

CLINICAL NOTES



REPAIR OF ACQUIRED FOREHEAD DEFECTS BY TANTALUM CRANIOPLASTY AND PLASTIC SURGERY

Report of Two Cases

JOHN T. GIANNINI

Lieutenant Commander (MC) U. S. N.

EDGAR N. WEAVER

Lieutenant, Junior grade (MC) U. S. N. R.

and

EDWARD KLOOS

Lieutenant, Junior grade (MC) U. S. N. R.

The procedures to be outlined are not considered by the authors to be new, but are the employment of single, previously-described and accepted procedures in combination, to effect excision, cranioplasty, and plastic repair in a single operation. If this method is carefully planned and executed it may be expected to give good results.

CASE REPORTS

Case 1.—This patient was admitted to the U. S. Naval Hospital, Bethesda, Md., because of a depressed scar of the forehead, the result of loss of frontal bone (figs. 1 and 2). The patient had received a head wound in action in World War II when hit by a shell fragment. He received emergency treatment and debridement in the Pacific Area and was later evacuated to Continental United States and transferred to this hospital for plastic repair. The neurosurgical and plastic surgery departments decided upon a combined operation and at the optimum time the patient was prepared for surgery by shaving the entire scalp. After the necessary preliminary sedation, he was given intratracheal ether anesthesia and the operation was begun. The scar tissue was excised by an incision which extended from the middle of the hairline obliquely to about 1 cm. above the center of the right eyebrow; and the margins of the bony deformity were outlined (fig. 3). The pericranium at the margins of the defect was elevated and a tantalum plate was molded to give a satisfactory forehead contour. It was then secured under the pericranium, to the frontal bone with several Vitallium screws. A pedicle skin flap was then outlined from the lower pole of the original incision, laterally, just above the right eyebrow to the lateral edge of the right eyebrow; and, from the superior edge of the incision, at the midhairline, extending



Figure 1.—Front view showing scarred forehead defect.

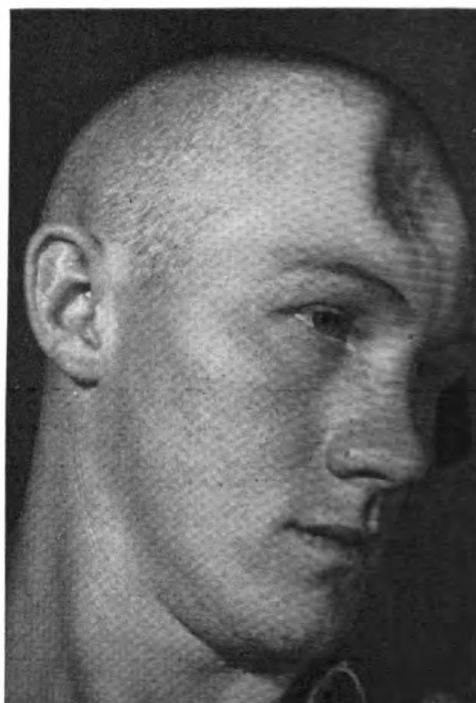


Figure 2.—Oblique view showing forehead defect.

back into the hairline to about 3 inches above the right ear (fig. 4). Bleeding was controlled with fine catgut ligatures and the skin flap was rotated and advanced over the tantalum plate to meet the previously undercut flap on the left side of the forehead. In order to completely cover the excised area on the forehead with the rotated skin flap, it was necessary to leave a gap in the scalp, back of the hairline (fig. 5). This was covered with a split thickness graft



Figure 3.—Scar excised down to dura and bony margins.



Figure 4.—Showing line of incisions for pedicle flap.



Figure 5.—Forehead wound sutured—area to be grafted seen back of hairline.

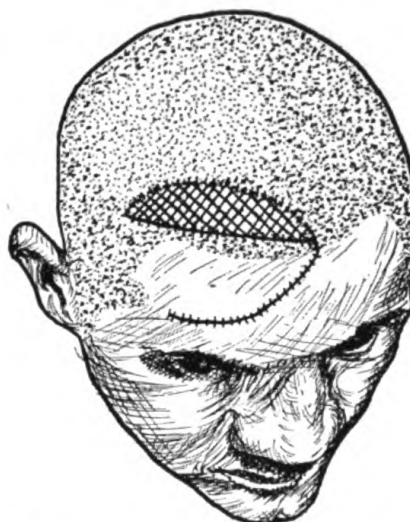


Figure 6.—Final result showing forehead incision and grafted area.

(fig. 6). The wound healed by first intention. The results are considered good functionally and cosmetically (fig. 7).

Case 2.—This patient was admitted to the U. S. Naval Hospital, Bethesda, Md., because of a reddened pulsating area on the right forehead. There had been two previous operative attempts without satisfactory results.

The patient gave a history of having noticed a small reddened area on the right side of the forehead since childhood which has become gradually larger.

Shortly after his entry into the armed services in 1941 he began to notice a slight pulsation of the mass. Because of the pulsation he became alarmed and presented himself to his medical officer whereupon he was transferred to a service hospital for treatment. There was no associate pain. Two excisions were attempted but without satisfactory outcome and he was transferred to the U. S. Naval Hospital, Bethesda, Md.

A previous diagnosis of hemangioma of the forehead had been made. On admission to this activity, an examination showed a reddened and scarred pulsating area of the forehead in which there was a chronic draining sinus in the lower angle. The drainage subsided after local debridement and a quiescent period. The right superficial temporal artery and branches were markedly dilated and tortuous, the pulsations of



Figure 7.—Postoperative view of patient 9 months later.



Figure 8.—*Oblique view of patient showing forehead defect.*

which were causing some erosion of the frontal bone in their distribution. Because of the bone erosion and the unsightly appearance of the pulsating arterial branches, the superficial temporal artery was sectioned by a small incision in front of the ear. This caused a marked diminution of the pulsations in the temporal and frontal region.

In the repair of the forehead defect, a combined neurosurgical and plastic surgery operation was planned, and 3 weeks after the temporal artery procedure, the patient was prepared for surgery in the usual manner. Under intratracheal ether anesthesia, the operation was begun. The epithelium and scar were excised, including the red area, exposing the dura and margins of the bony defect. The dura appeared normal. There was marked thinning of the frontal bone which otherwise appeared normal. The pericranium was elevated and a tantalum plate was molded to fit the defect. This was

placed in position and secured by several tantalum wire sutures to the pericranium. Because of the thinness of the bone, the use of the usual Vitallium screws was impossible. Following the insertion of the tantalum plate it was necessary to mobilize lateral skin flaps to bridge the defect left after excision of the involved area. These skin flaps were raised laterally, using the hairline as the superior

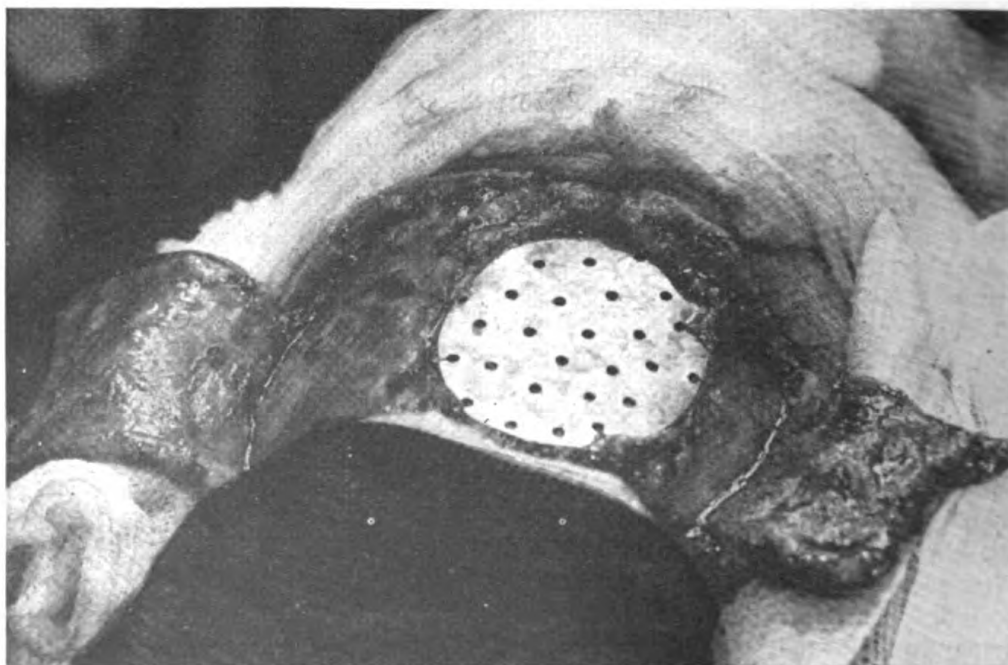


Figure 9.—*Photograph showing tantalum plate in situ and lateral skin flaps.*

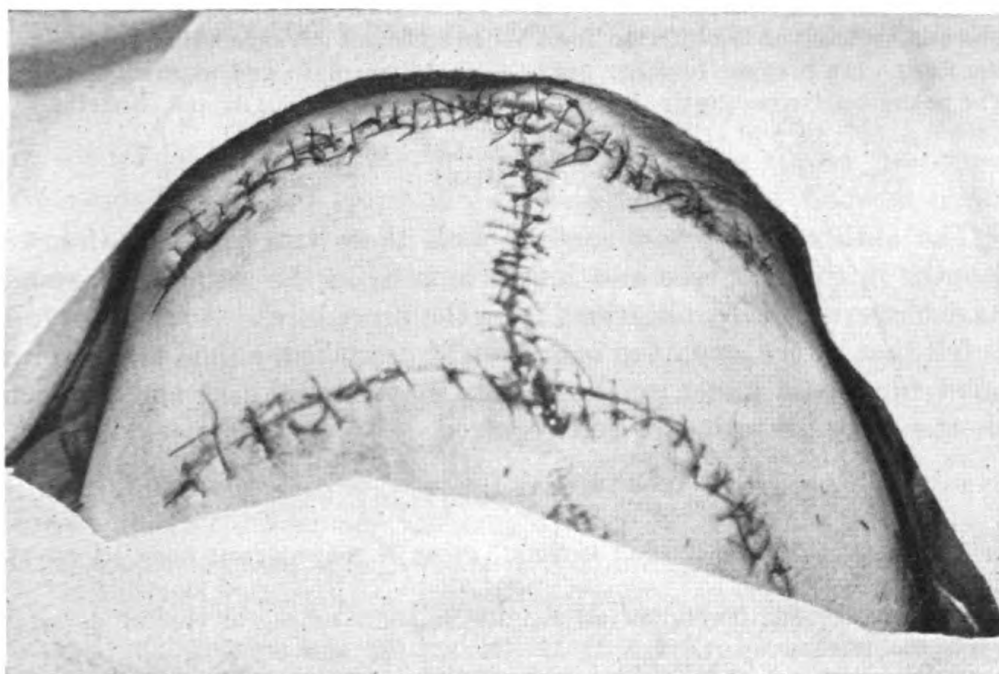


Figure 10.—Photograph showing final sutures.



Figure 11.—Appearance of patient 3 months after operation.

line and eyebrow as the inferior line. When sufficient advancement was obtained the flaps were brought together over the tantalum plate and sutured in place. The postoperative results are considered to be good functionally and cosmetically. (See figs. 8, 9, 10, and 11.)

COMMENT

The authors have had contact with these two patients—for 18 months in the first case and for 15 months in the second case—and have observed no complications from the procedures. Accordingly, it is felt that by the combined operation as described, a final result with good functional and cosmetic results may be obtained and a much shorter hospitalization period required.

BIBLIOGRAPHY

1. JAEGER, R.: Closure of skull defects. *Plast. & Reconstruct. Surg.* 1:69-77, July 1946.
2. FULCHER, O. H.: Tantalum as metallic implant to repair cranial defects: preliminary report. *J. A. M. A.* 121: 931-933, Mar. 20, 1943.
3. GARDNER, W. J.: Closure of defects of skull with tantalum. *Surg., Gynec. & Obst.* 30: 303-312, Mar. 1945.
4. NEW, G. B.: Sickie flap for nasal reconstruction. *Surg., Gynec. & Obst.* 80: 497-499, May 1945.
5. KAZANJIAN, V. H.: Reconstruction of deformities of forehead and frontal bone. *Tr. Am. Soc. Plast. & Reconstruct. Surg.* 12: 83-97, 1943.



METASTATIC BRAIN ABSCESS ORIGINATING IN THE LUNGS TREATED WITH MASSIVE DOSES OF PENICILLIN

Report of a Case

THOMAS I. HOEN¹

Captain (MC) U. S. N. R.

ROBERT K. ANDERSON, M. D.²

and

FRANK B. CLARE

Lieutenant (MC) U. S. N.

The treatment of brain abscess in general was well established long ago by Macewen (8) and even the advent of chemotherapy and modern supportive therapy has not detracted significantly from his impressive

¹ Inactive.

² Formerly Lieutenant Commander (MC) U. S. N.

results. However, he reported no cases of recovery of brain abscess secondary to pulmonary infection. Until quite recently the mortality rate of such cases was regarded at 100 per cent (9). The severity of the initial intrathoracic disease, the depth of the abscess, failure of the secondary brain abscess to localize properly, and frequent occurrence of multiple abscesses have all been factors responsible for the poor prognosis in these cases. During the past 10 years only a handful of such cases with good recovery have been reported (2) (4) (5) (7). These cases were all treated both surgically and chemotherapeutically. The case reported here is believed to be significant because the treatment was entirely chemotherapeutic; although the site of the abscess was located through a trephine opening with a brain needle, no form of surgical drainage was employed.

The route by which organisms pass from a suppurative process in the lung to the brain is an interesting problem. Metastatic abscesses attendant upon intrathoracic disease are known to occur almost exclusively in the brain (1) (3). Probably the best explanation is that advanced by Batson which is based upon the existence of a large intercommunicating system of veins. The spinal and vertebral veins are the main channels which anastomose with the azygos, bronchial and intercostal veins. These great veins lack effective valves and under some conditions act as storage lakes as well as a drainage system. They are known to be the site of frequent reversals of flow, especially when the intrathoracic and intraabdominal pressures are increased as in coughing and straining. Under these conditions, they may become a channel for the passage of bacteria from the lungs to the brain.

Surgical treatment of all types of brain abscesses has been believed to be the prime factor in their treatment, and chemotherapy was utilized chiefly as an adjunct. In the case that is presented in this article, it appears that the reverse may be true in metastatic abscess; and that surgical drainage may have to be resorted to less often if the disease is treated early with adequate doses of penicillin and sulfonamides and continued for a sufficient time. For it must be admitted that surgical drainage may in itself cause further damage to the brain. Approximately 50 per cent of the patients so treated who recover, subsequently develop convulsive seizures.

In this case a large brain abscess complicating pneumonia and lung abscess absorbed completely; and as a result the patient shows minimal cerebral damage and a maximum return of function as manifested by clinical recovery and the return of the pneumoencephalogram and the electroencephalogram to normal at completion of this therapy.

CASE REPORT

H. P. F., a 20-year-old white male was admitted to a civilian hospital on 1 January 1946 after 3 days of illness at home with what was thought to be influenza. The diagnosis of primary atypical pneumonia was made and he was treated with penicillin for 5 days. His condition improved and he was transferred to this activity on 7 January. His complaints at that time were: cough, bilateral tightness in chest, pain on right side of the chest on deep inspiration, and considerable weight loss in the past week. Physical examination showed him to be a pale, thin, sallow, white male, moderately ill, and dehydrated. Respiratory lag of the right chest, diminished resonance and fremitus of the right lung were present. Ronchi were audible throughout both sides of the chest. He had a slight generalized adenopathy. The temperature, pulse, respirations, and white blood cell count were normal. A roentgenogram revealed a residual infiltration in the

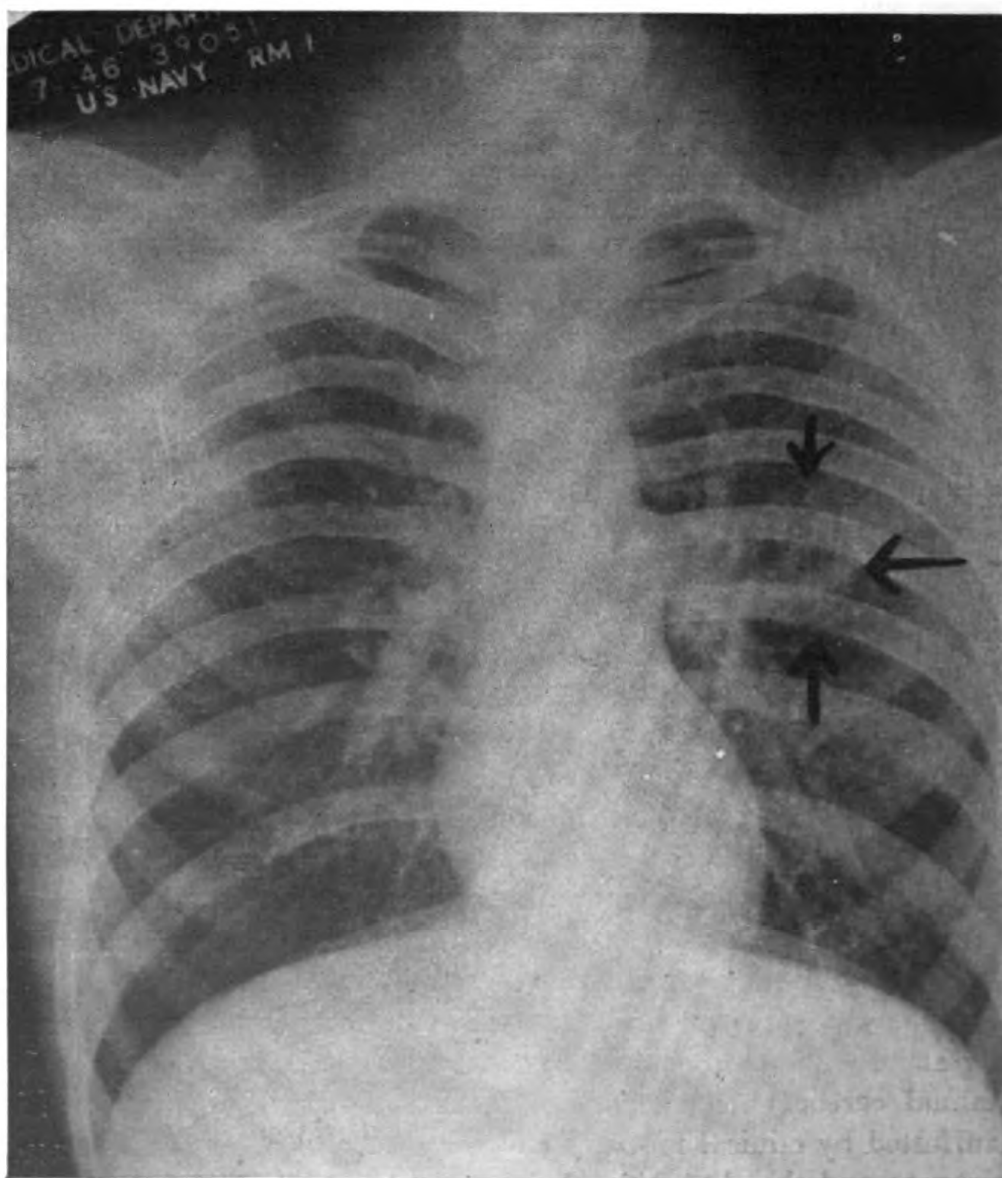


Figure 1.—Roentgenogram of 9 January 1946 showing cavitation of left chest anteriorly.

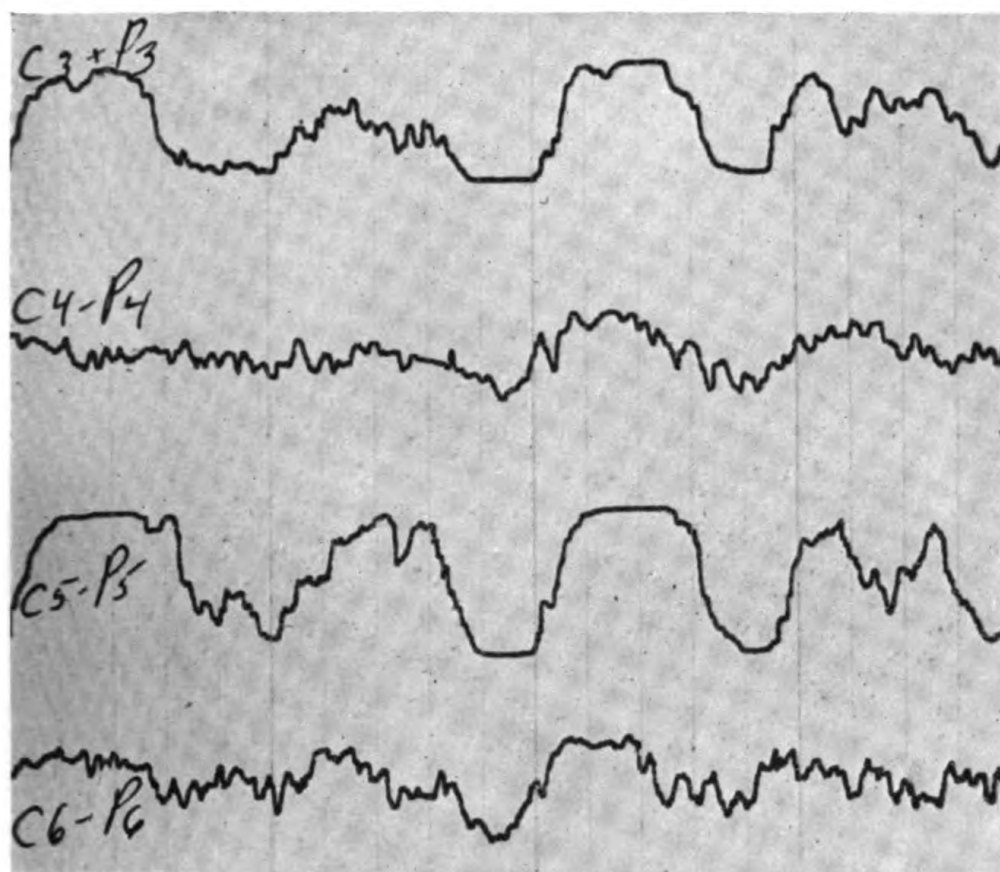


Figure 2.—Electroencephalographic tracings, 15 January 1946.

region of the third rib anteriorly, suggestive of a resolving virus pneumonia. Sputum examinations were negative. He was treated symptomatically.

His condition remained clinically unchanged until 9 January at which time he first complained of frontal headache. The following day he complained of photophobia. There was moderate nuchal rigidity and a suggestive Kernig's sign. Roentgenograms of the chest now showed signs of cavitation in the left chest anteriorly in the region of the third rib (fig. 1). A lumbar puncture was done and a pressure of 300 mm. recorded. Dynamics were normal: white blood cells 80, with 30 segmented cells and 50 lymphocytes. Pandy was 2 plus and globulin 43 mg. Smears and cultures were negative for organisms. Temperature, pulse, and respirations were still normal. He was given 20,000 units of penicillin every 3 hours.

On the afternoon of 12 January he became confused and started having difficulty saying words. Lumbar puncture showed: a pressure of 260 mm., fluid clear, white blood cells 116 of which 102 were lymphocytes. Cultures and smears were again negative for organisms. White cell count of the blood at this time was 19,000 of which 80 percent were segmented.

He became progressively worse and on 15 January he was seen by the neurosurgeon and transferred to the neurosurgical service. At that time his symptoms were (a) drowsiness and confusion; (b) difficulty in seeing objects to his right; (c) persistent steady frontal headaches; and (d) difficulty in saying words. Physical examination showed a right homonymous hemianopsia with a split macula, papilledema three diopters bilateral. The right biceps reflex was increased over the left. Temperature, pulse, and respirations were normal. It was

felt that he had a space-occupying lesion in the left temporal region—probably an abscess. Roentgenograms of the skull were negative. An electroencephalographic tracing was compatible with a space-occupying lesion in the left parieto-temporal region (fig. 2). The dose of penicillin was increased to 40,000 units every 3 hours and sulfadiazine 15 grains with 30 grains of sodium bicarbonate every 4 hours was also given.

Although it was not felt that sufficient time had elapsed for satisfactory encapsulation of an abscess, the patient's rapid deterioration necessitated intervention. A trephine was made in the left parieto-occipital region, and a

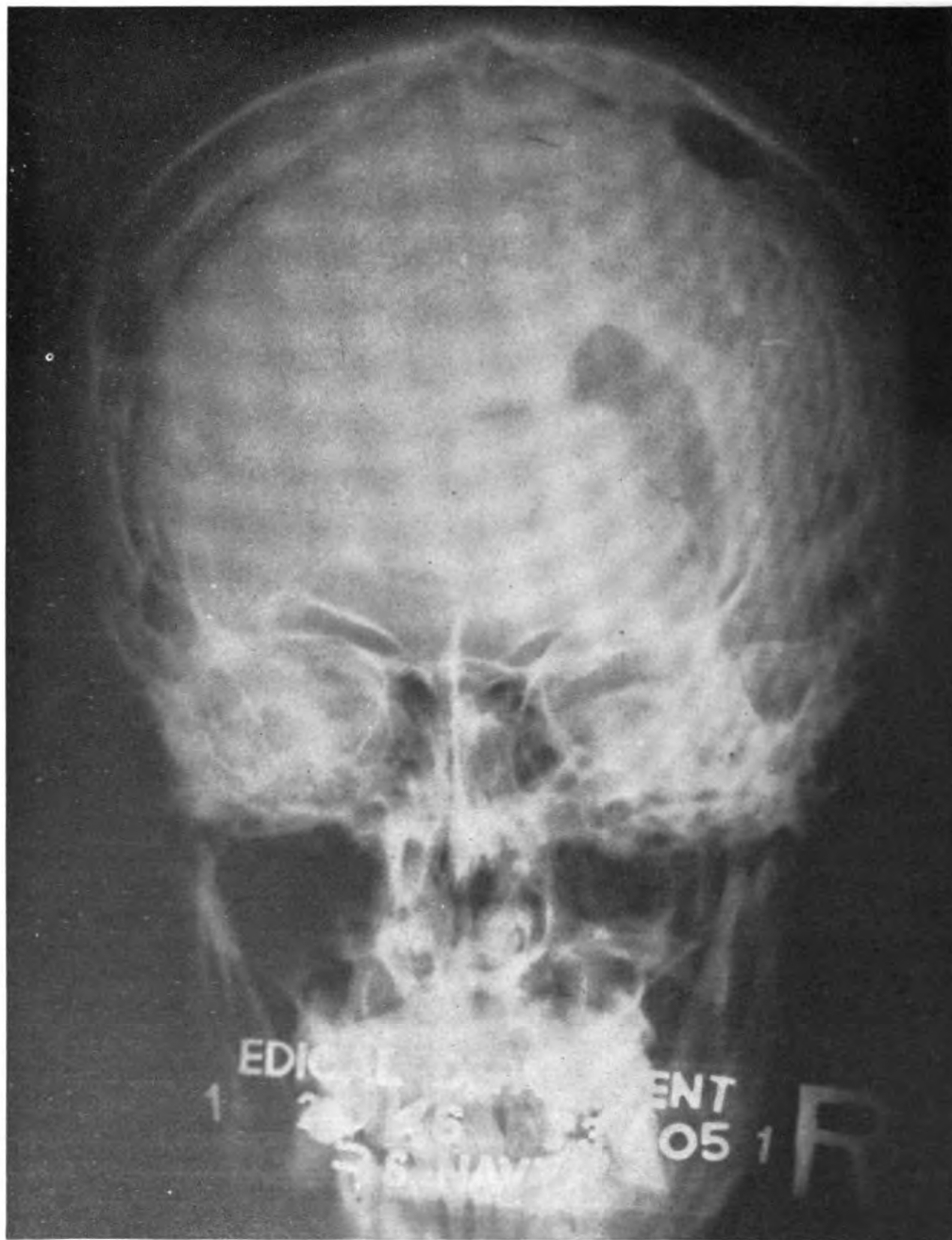


Figure 3.—Ventriculogram taken on 20 January 1946.



Figure 4.—Ventriculogram taken on 20 January 1946.

brain needle was inserted; slight resistance encountered at 4 cm. depth. Carrying beyond this a few drops of thick, sticky, gelatinous pus were obtained. A No. 14 catheter was inserted into the same region but no drainage was obtained. It was felt that the abscess was too immature for drainage and the catheter was removed and the wound closed. A trephine was made on the right side for subsequent ventricular taps. A smear of the pus showed some necrotic brain tissue with pus cells and numerous staphylococci. No organisms grew on culture.

The patient's condition remained approximately the same and on 20 January a ventriculogram was made using the right trephine. The findings indicated a large space-occupying lesion in the left occipital lobe (figs. 3 and 4). Penicillin was increased to 60,000 units every 3 hours. Sulfadiazine was discontinued 3 days later because of the appearance of crystals in his urine and also to keep the patient relatively dehydrated.

On 31 January the parieto-occipital area of the brain was again explored with a brain needle. No abscess cavity could be located. Twelve cubic centimeters of clear fluid was then withdrawn from the right lateral ventricle and he was given 5 grains sulfathiazole with 30 grains sodium bicarbonate every 4 hours in addition to his penicillin. His general condition was fair; complaints and physical findings were essentially the same as on admission to this service.

From that date on there was general improvement in the patient's condition. The papilledema gradually subsided. The speech defect improved. He became more interested and alert. By 16 February he was sitting up in a chair for 2 hours daily. Photophobia was gone but his hemianopsia persisted. On 27 February another ventriculogram was done which showed marked improvement.

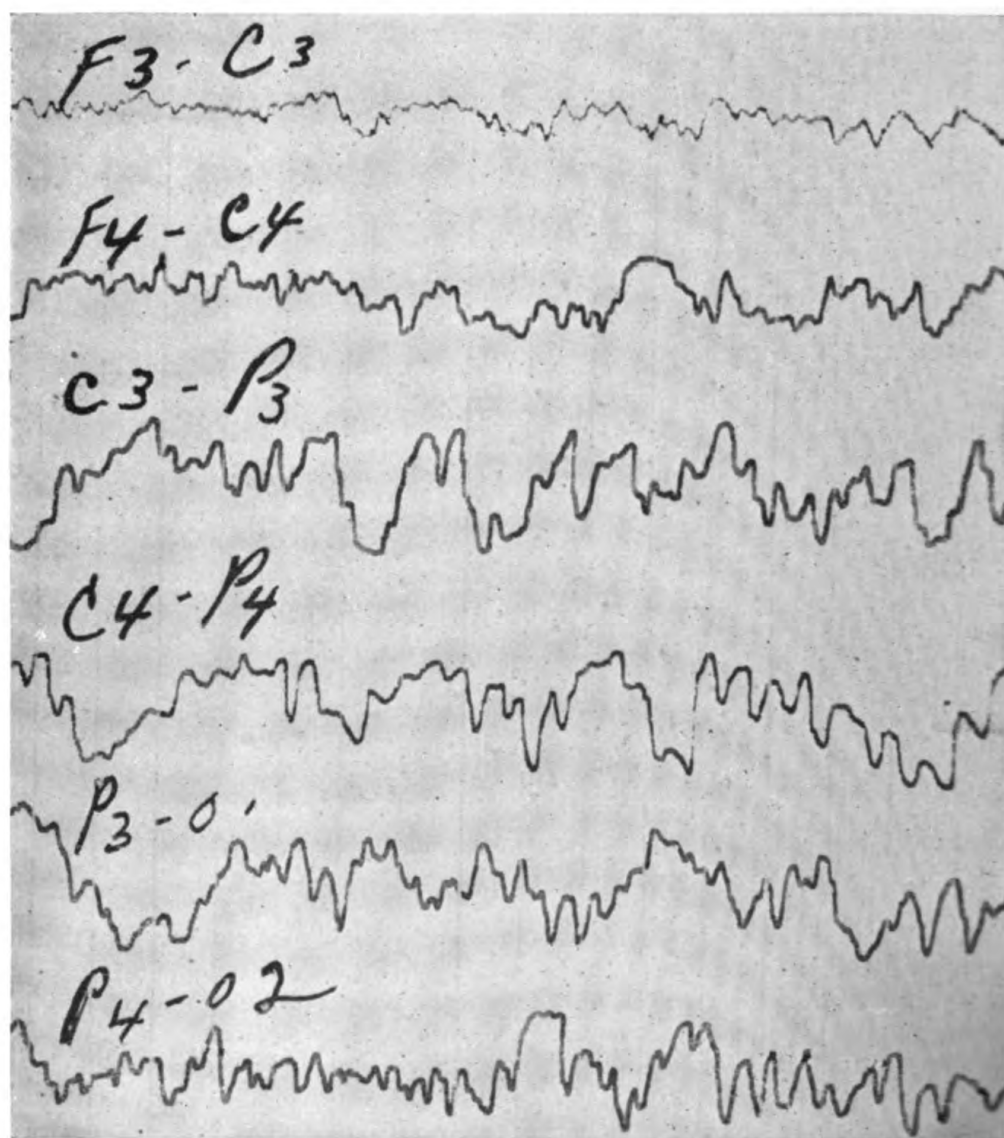


Figure 5.—Electroencephalographic tracings, 15 April 1946.

Penicillin was reduced to 30,000 units every 3 hours on 19 February and discontinued on 11 March.

By the middle of April the patient was up and around, working, going on liberty, and feeling fine. His visual fields were improved but he still had a partial right homonymous hemianopsia. An electroencephalogram showed increased irritation in the previously described area (fig. 5). Pneumoencephalograms showed return to normal (figs. 6 and 7). Spinal fluid studies were normal. On 5 May electroencephalographic tracings had returned to normal limits (fig. 8). The patient had gained 15 pounds and was ready for discharge from the hospital.

A 2-year follow-up reveals that this patient is still in good health and symptom-free. One year ago, however, he had two convulsive seizures. These were completely controlled with dilantin and he is still taking the drug prophylactically. He is working 6 days a week and doing well.

It is interesting to note that this man received a total of 800,000 units of penicillin before entering the hospital. There followed a period of 5 days in which he received no penicillin. Here he received a total of 22,240,000 units over a period of 2 months. In addition he received 54 grams of sulfadiazine and 72 grams of sulfathiazole. He was given large doses of thiamine and multivitamins during this period.

SUMMARY

A case of metastatic brain abscess, from a lung abscess (organisms *Staphylococcus albus*), treated only by chemotherapy has been presented. The end result was excellent as measured by clinical recovery, resolution of the abscess mass as demonstrated by the pneumoencephalogram and the return of the electroencephalogram to normal at completion of this therapy.



Figure 6.—Pneumoencephalograms taken on 17 April 1946.



Figure 7.—Pneumoencephalogram taken 17 April 1946.

REMARKS

1. If an early metastatic brain abscess or abscesses caused by an organism that is amenable to chemotherapy is treated with massive doses of penicillin and sulfonamides (as tolerated) a good recovery may ensue without resort to open drainage.

2. Although penicillin administered parenterally does not normally appear in the spinal fluid, in the presence of meningeal irritation the concentration of penicillin in the cerebrospinal fluid reaches effective

levels. This case presents further evidence that massive doses of parenteral penicillin are effective in inflammatory disease of the central nervous system and that intrathecal injection is not necessary.

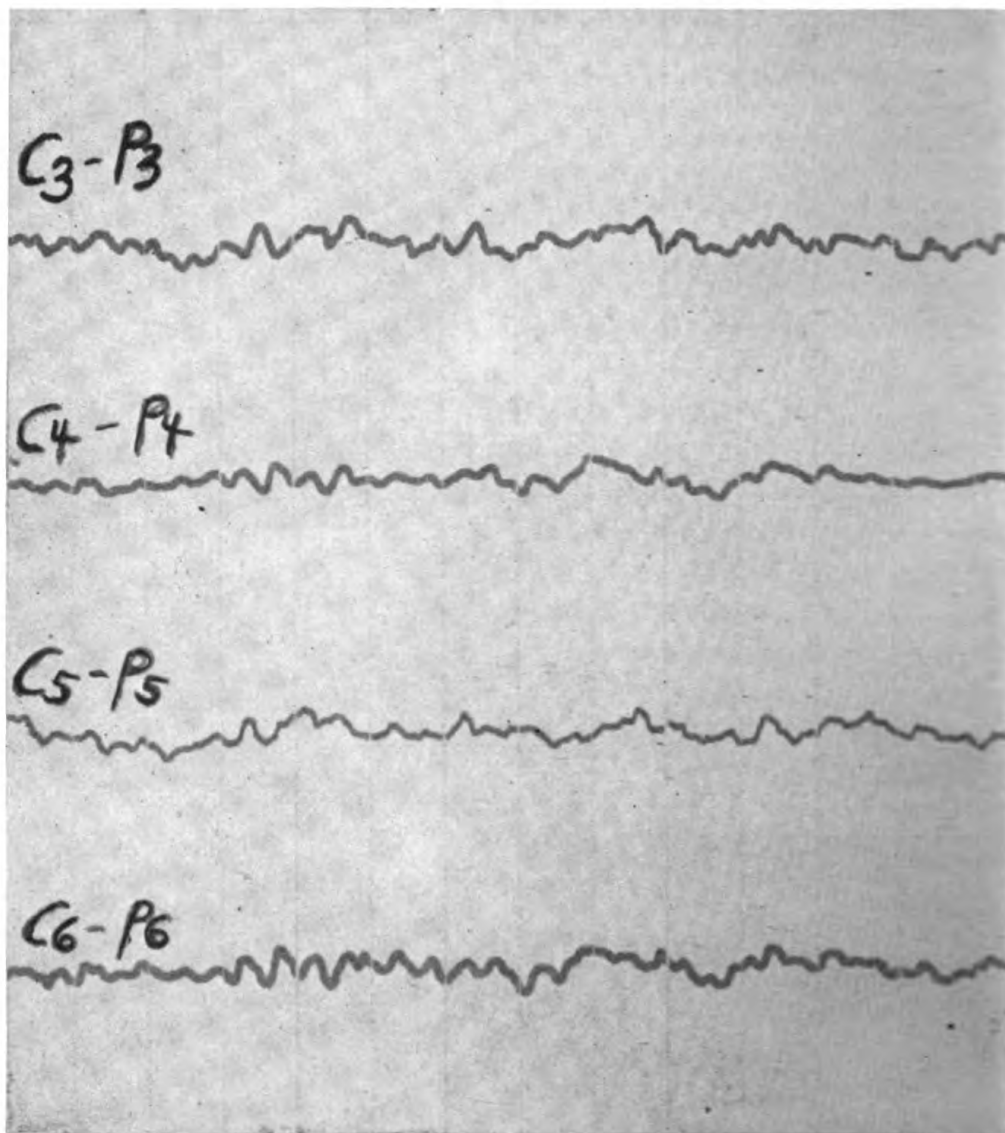


Figure 8.—Electroencephalographic tracings, 5 May 1946.

REFERENCES

1. BATSON, O. V.: Function of vertebral veins and their role in spread of metastasis. *Ann. Surg.* 112: 138-149, July 1940.
2. COHEN, I., and DROOZ, R. B.: Brain abscess metastatic from lung; recovery following penicillin therapy and repeated aspirations. *J. Neurosurg.* 2: 456-459, Sept. 1945.
3. COLLIS, J. L.: Etiology of cerebral abscess as complication of thoracic disease (Hunterian lecture, abridged). *Thoracic Surg.* 13: 445-470, Dec. 1944.

4. GRANT, F. C.: Brain abscess; collective review. *Internat. Abstr. Surg.* 72: 118-138, 1941 in *Surg., Gynec. & Obst.*, Feb. 1941.
5. GRANT, A.: Cerebral abscess; account of successful case. *M. J. Australia* 1: 349-350, Apr. 7, 1945.
6. GURDJIAN, E. S., and WEBSTER, J. E.: Observation on standardizing the surgical management of intracranial suppuration. *J. Neurosurg.* 5: 1, Jan. 1948.
7. LEBEAU, M. J.: Traitement chirurgical des abcès du cerveau depuis la pénicilline, *Press méd.* 54: 414-416, June 22, 1946; abstr., *Sur le traitement chirurgical des abcès des hémisphères cérébraux*, *Rev. neurol.* 77: 331-332, Nov.-Dec. 1945.
8. MACEWEN, W.: *Pyogenic Infective Disease of the Brain and Spinal Cord.* The Macmillan Co., New York, N. Y., 1893.
9. RUHBERG, G. N.: Metastatic brain abscesses. *Minnesota Med.* 25: 108-113, Feb. 1942.



MESOTHELIOMA OF THE PERITONEUM

BRUCE H. SMITH, JR.
Lieutenant (MC) U. S. N.

Although secondary tumors of the serosal surfaces occur frequently, primary neoplasms are uncommon, especially when arising from the peritoneum. Few instances of this lesion have been reported in the literature, but the cases reported are fairly consistent in gross and microscopic description. Despite the simplicity of the anatomic structure from which these tumors originate and the relative consistency of the pathologic reports, considerable controversy as to the nomenclature of these tumors and confusion as to their actual cellular origin has arisen.

It will be recalled that the peritoneum originates by a splitting of the embryonic mesenchyma giving rise to a specialized mesenchymal cell which later becomes the squamous cell lining the peritoneal cavity. Immediately beneath this single layer of flattened mesothelium lies loose areolar connective tissue through which a network of lymphatics and small blood vessels, both lined by endothelial cells, is found. Some authors think that the tumors arise from these squamous cells. Harvy, Dawson, and Innes (5) have called them membranoformative endothelioma for this reason. However, Miller and Wynn (6) called them endothelioma, believing that they originated from the lymphatic endothelium. Whatever the origin, the term mesothelioma has recently been used and the writer will conform to this term since he believes that this controversy is at the present unsolved.

Rokitansky described what is probably the first reported primary tumor of the peritoneum when in 1854 he reported a "colloid type cancer" which apparently had its origin in this structure. In 1895 Herschfeld presented a similar case and in 1897 Glockner first defined these tumors as primary endotheliomata on the assumption that they arose from the endothelium of the lymph channels. Ziegler offered similar findings in 1905 but admitted the possibility of origin in the lining cells. In 1907 Miller and Wynn (6) published the details of a case which they considered to be an endothelioma arising in the lymphatic endothelium and included what was probably the best review of the literature up to that time. Since then scattered case reports have appeared but no further conclusive evidence has been offered as to any of the controversial points.

As has already been mentioned, the first cases reported were described as "colloid" types of cancer, due to the large number of cysts containing mucoid material and nodular elevations on the tumor surfaces. Although the gross changes of the later-described neoplasms has confirmed the nodular appearance and the presence of cysts in most cases, the cystic areas have been minimal. Macroscopically, the majority of reported cases have been described as thickening of the serosal surface with a roughened nodular appearance, adhesions and matting of the various serosal surfaces to form tumor masses. The great majority have apparently arisen from the serosa over the bowel, although other sites have been reported. Only one case, however, has been reported as arising in the omentum (9).

Microscopically the tumors were, with variations, composed of large ovoid, polygonal, cylindroid, and giant cells in varying ratios, enmeshed in reticulum fibers and showing interfasciculation of collagenous fiber bands. Pseudopapillary projections on the external surfaces have been reported by several authors but in no case have invasion of the lymphatics or blood vessels with distant metastasis been observed. These tumors are locally invasive showing considerable invasion of the subperitoneal tissue and although infiltrating viscera and mesenteric lymph nodes on all sides will leave the central portions untouched. Another interesting point which has been noted by several workers (5) (6) (8) is the intimate relationship between the large tumor cells and the network of fine fibrils which in several cases have been thought to be outgrowths of the cells. Miller and Wynn were the first to bring out this point which they observed with the use of van Gieson's stain. Phagocytosis, as demonstrated by the neoplastic cells, has been noted by several authors (2) (5) (6), but the interpretation of this is a matter of considerable discussion and controversy. The mucoid material in the cysts has been interpreted by most authors as originating in the tumor cells because some of them show vacuoles sug-

gesting the presence of fluid material within the cells. This substance has been termed mucoid by the endothelial advocates following the suggestion of Conheim that the term "mucin" be reserved for the product of epithelial cells.

The case which follows presents essentially the same pathological findings as those observed by other workers and is offered to complete further the scientific records of so rare a neoplasm.

CASE REPORT

The patient was a 54-year-old white male who first noticed the onset of vague abdominal discomfort and constipation in January 1945. It was progressive in type and associated with the loss of from 20 to 30 pounds of weight until December 1945, when an abdominal mass was palpated and a rectal tumor shelf was discovered. He was admitted to a U. S. naval hospital, where an exploratory laparotomy was performed on 17 December 1945. A widespread carcinomatoid growth involving all of the abdominal viscera was found. A specimen for biopsy

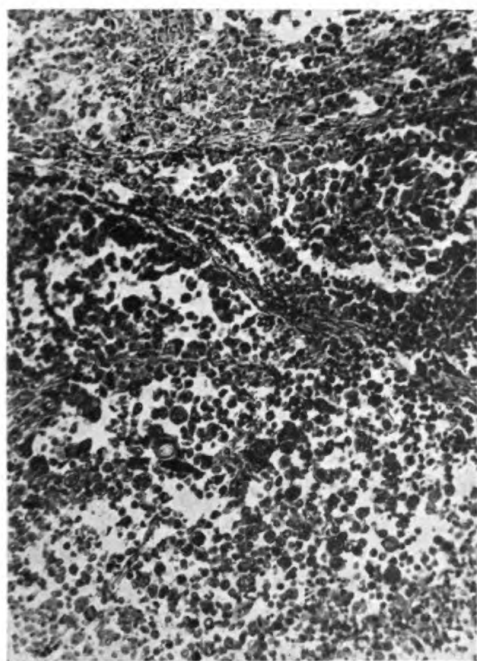


Figure 1.

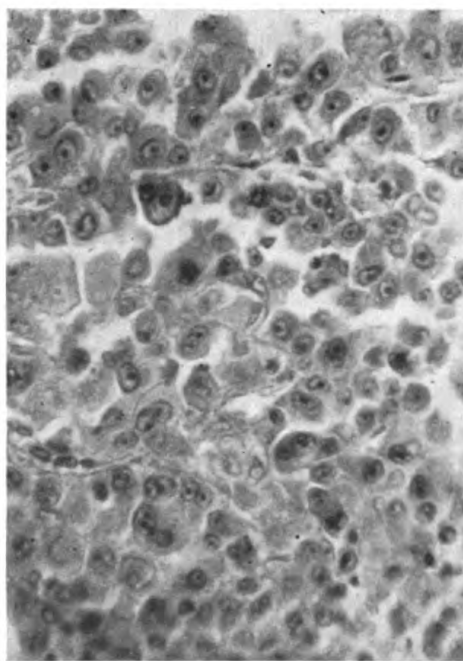


Figure 2.

Figures 1 and 2.—Low and high dry fields showing the general histologic appearance of the neoplasm in this case.

was taken and the abdomen was closed. The patient (and slides) was later sent to the U. S. Naval Hospital, Brooklyn, N. Y. Careful questioning at this activity brought out the fact that this man had had a tumor removed from the vicinity of his right vas deferens in 1937. This was reported as an endothelioma and the patient was given high voltage roentgen therapy to his right inguinal region.

On admission to this hospital the patient was found to be in no apparent acute distress, but was underweight, undernourished, and slightly anemic. Physical

examination revealed the presence of a large, ill-defined mass in the left side of the abdomen. No other unusual physical findings were noted.

The patient's slides were reviewed at this hospital and at Memorial Hospital, New York, N. Y., and the diagnosis of "mesothelioma of the peritoneum" was agreed upon.

Roentgenographic examination of the gastro-intestinal tract revealed no abnormalities. Laboratory findings including red blood cell count, white blood cell count, and differential count, urine, Kahn test, icterus index, and total blood protein were normal. Sedimentation rate was 25 mm. in 1 hour.

On 10 January 1946 he was started on high voltage roentgen therapy of 200 r daily to three successive abdominal and lumbar portals for a total of 2,000 r to each portal. There was some apparent decrease in the size of the mass and relief from symptoms.

By the end of March 1946, his symptoms had returned and the physical signs of ascites could be elicited. Chest film and intravenous pyelogram at this time were normal. Repeated paracentesis gave some relief. Tumor cells could be recognized in the withdrawn fluid. The patient failed progressively and died on 3 September 1946.

AUTOPSY

At autopsy the interesting anatomic changes were limited to the abdomen. Two thousand cubic centimeters of slightly turbid amber-colored fluid were withdrawn as the peritoneal cavity was opened, and a large tumor mass measuring 30 by 26 by 15 cm. could be seen filling almost the entire abdomen and involving practically all of the abdominal viscera. Only the liver, spleen, and kidneys could be dissected away by making artificial lines of cleavage where they were superficially invaded. The stomach, the small and the large intestines were all matted in this mass but no sign of obstruction could be found and careful investigation revealed the mucosa to be intact throughout, thus excluding the gastro-intestinal mucosa as a primary site. The mass itself was firm in consistency, yellowish-grey in color, and section showed it to be neither fibrous nor gritty. The surfaces for the most part were smooth and the same nodular elevations could be seen. No mucous cysts could be found anywhere in the substance of the tumor and no possible gross primary site could be elicited. The neoplasm itself grossly appeared to originate from the peritoneal surfaces with thickening and matting of these structures. Investigation of the right inguinal canal and testicle revealed no residual tumor from the old (1937) operative site.

Microscopically the tumor was quite cellular and composed of cells of various sizes and shapes with a large polygonal cell predominating. These cells were enmeshed in a network of reticulum and collagenous fibers thereby presenting an interfasciculated appearance. Multinucleated giant cells were not uncommon and mitosis was fairly frequent. Phagocytosis of red blood cells could be seen in some portions. Areas of necrosis and scattered inflammatory cells of the polymorphonuclear type could be recognized. The tumor cells themselves presented large hyperchromatic nuclei with prominent chromatin and nucleoli. The giant cells contained from 2 to 6 nuclei on the average and had the same staining qualities as the other cells. In some areas the cells were less anaplastic in character and assumed platelike forms with arrangements in sheets and thereby somewhat resembling mesothelial cells.

COMMENT

Several interesting points in regard to this case do require comment. The first manifestation of this tumor showed itself in the scrotum,

apparently arising from a portion of the serous membranes surrounding the vas deferens. Whether or not this is the original site or whether the tumor arose higher and extended through the inguinal canal is not known but it did continue to grow and eventually to involve the whole of the peritoneal surface. It is also noted that this mass receded with x-radiation, an observation which has been seen before. Although this particular neoplasm is not so radio sensitive as the lymphomas, for instance, much relief can be obtained from this therapeutic agent. It is interesting that even though this man had extensive involvement of his abdominal viscera the gastro-intestinal lumen remained patent and functioned until death, which resulted from inanition rather than intestinal obstruction.

SUMMARY

A case of mesothelioma of the peritoneum with a brief discussion and short review of the subject is presented.

REFERENCES

1. CONNOLLY, A. E.: Endothelia of peritoneum; case report. *Brit. J. Radiol.* **16**: 153-154, May 1943.
2. EWING, J.: *Neoplastic Disease; a Treatise on Tumors*. 4th edition. W. B. Saunders Company, Philadelphia, Pa., 1940. pp. 356-359.
3. FERRARO, L.: *Il Policlinico (Sezione chirurgica)* **19**: 141, 1932.
4. HAMDI, H.; LOUTHAL, M.; and SCHEVKET: *Beitr. z. path. Anat. u. z. allg. Path.* **19**: 441, 1928.
5. HARVEY, W. F.; DAWSON, E. K.; and INNES, J. R. M.: *Debatable Tumors in Human and Animal Pathology*. Published for the Cancer Control Organisation of Edinburgh and South-East Scotland. Oliver & Boyd Ltd., Edinburgh, Scotland, 1940.
6. MILLER, R. T., and WYNN, W. H.: *J. Path. & Bact.* **12**: 267, 1908.
7. NICASTRO, G.: *Linfangioendotelioma primitivo generalizzato della sierosa peritoneale*. *Cultura med. mod.* **7**: 531-552, Aug. 31, 1928.
8. RAMSEY, T. L., and CHOMET, B.: *Mesothelioma (endothelioma) of peritoneum*. *Arch. Path.* **35**: 292-298, Feb. 1943.
9. SOWIAKOWSKI, J.: *Endothelioma of great omentum*. *Polska gaz. lek.* **15**: 434-436, June 7, 1936.
10. TARASCOA, T., and VANESCU, E.: *Bulletins Societe Medicale des hôpitaux de Bucarest* **21**: 180, 1939.

ACKNOWLEDGMENT.—The author wishes to acknowledge the helpful criticism of Dr. F. Stewart of Memorial Hospital, New York, N. Y., and Dr. J. A. DeVeer of Brooklyn Hospital, Brooklyn, N. Y., consultant pathologists to the U. S. Naval Hospital, Brooklyn, N. Y.



RAPID HEALING OF A PERFORATING PEPTIC ULCER FOLLOWING VAGOTOMY

Report of a Case

FERRELL H. JOHNSON

Captain (MC) U. S. N.

and

EDWARD A. KEARNEY

Commander (MC) U. S. N.

Our first subdiaphragmatic vagotomy as a procedure in the treatment of peptic ulcer at the U. S. Naval Hospital, St. Albans, N. Y., was performed in February 1947, and has subsequently been performed in 60 cases. There have been several instances of rapid healing of ulcers. The following case is reported because we believe the rapidity of healing is phenomenal.

CASE REPORT

H. J. F., a retired warrant officer, 45 years old, was admitted to the U. S. Naval Hospital, St. Albans, 21 April 1947, complaining of severe upper abdominal



Figure 1.—Preoperative roentgenogram.



Figure 2.—Roentgenogram taken 21 days after vagotomy.

pain of 1-month duration. He gave a history of ulcer dating back to 1927. A posterior gastroenterostomy had been performed on him at the U. S. Naval Hospital, Mare Island, Calif., on 3 October 1934. At the time of that operation he was found to have an ulcer of the first portion of the duodenum which was surrounded by dense adhesions which caused the operator to believe there had at one time been a perforation. He was free of symptoms for about 6 months at the end of which time his symptoms returned. He was treated and hospitalized numerous times during the next few years. In 1944, at the U. S. Naval Hospital, Sampson, N. Y., he was found to have a large penetrating lesion high on the lesser curvature of the stomach. After rather extensive study and prolonged ineffectual treatment he was released from active duty in January 1945. Surgery was advised at that time, but was refused by the patient.

From January 1945 until 1 month prior to admission, the patient had only occasional symptoms of short duration. One month prior to admission he began to have severe pain which was not relieved by food or antacids. Shortly after admission to this hospital on 21 April 1947, the pain became so severe and was accompanied by such epigastric tenderness and rigidity that he was suspected of having a perforation and was transferred to the surgical service. However, he was treated conservatively and roentgenological examination revealed a large perforating ulcer which was estimated to be 1 inch in diameter high on the lesser curvature of the stomach.

On 13 May 1947 the patient was subjected to upper abdominal exploratory operation and a large ulcer $1\frac{1}{2}$ inches in diameter was found on the posterior

wall of the stomach near the vertical portion of the lesser curvature; it had penetrated into the pancreas. A vagotomy only was performed.

The patient received immediate relief from pain and made a rapid recovery. On 21 May 1947, his eighth postoperative day, gastro-intestinal roentgenograms failed to show the large ulcer on the lesser curvature. Gastro-intestinal roentgenograms on 2 June 1947 again failed to show any evidence of ulcer. The patient was discharged from the hospital on 3 June 1947. At that time he was symptom-free and eating a regular diet. He has been seen twice since, the last time in October 1947, at which time he reported that he was symptom-free, had gained 20 pounds in weight, and was highly satisfied with his operation.

COMMENT

The inability to demonstrate any evidence of this large ulcer by roentgenography on the eighth and twenty-sixth postoperative days, accompanied as it was by immediate and complete cessation of pain seems rather remarkable and informative and has served to increase our enthusiasm for and confidence in vagotomy as a procedure in the treatment of benign peptic ulcer.



SPONTANEOUS CHYLOUS ASCITES

Report of a Case

LEWIS L. HAYNES
Commander (MC) U. S. N.

The occurrence of chylous ascites is uncommon as is evident by the scant literature on the subject. This case is reported because of the rarity of this entity and because the symptoms were similar to those found in acute conditions within the abdomen. A review of the literature will not be undertaken; however, an analogous case was not found.

CASE REPORT

R. L. F., is a colored male, 21 years of age, who was well until 4 days prior to his admission to the U. S. Naval Hospital, Philadelphia, Pa., on 30 April 1946. He stated that after the evening meal on 26 April 1946 he developed a pain in his left lower abdomen. The pain persisted the following day, 27 April 1946, but was mild and he played baseball in the afternoon. In the evening he had a chill and complained of generalized aching muscular pains. The pain in his left lower abdominal quadrant continued and then gradually shifted to his right lower quadrant. He slept poorly because of the pain. The next morning, 28 April 1946, the pain in both lower abdominal quadrants increased and he complained of substernal pain and difficulty in swallowing.

He stated that he felt as though there was a lump in his chest. Food and water were swallowed with difficulty. On 30 April 1946 he had a severe chill and the pain and dysphagia increased so he sought medical treatment. The past history was negative except for gonorrhea 4 months prior to his admission. He had served on Guam for 12 months but had no illness while in the Tropics.

His temperature on admission was 100.8° F. and the pulse rate was 96. The physical examination was negative except for the abdomen. There was moderate distention and generalized abdominal tenderness, more marked in the right lower abdominal quadrant. There was some tenderness posteriorly on liver percussion. Rectal examination produced tenderness high on the right side. The white blood cell count was 11,450 with bands 12 percent, segmented forms 73 percent, lymphocytes 11 percent, and monocytes 4 percent. The urine showed a trace of albumin. He was given clear liquids and placed under surgical observation.

In the morning his dysphagia persisted and abdominal tenderness with voluntary muscle guarding was present in both lower abdominal quadrants and in the right flank. His condition remained unchanged until 2000 when he drank a glass of chocolate milk and immediately experienced severe epigastric pain causing him to cry out. When seen by the surgeon he had developed generalized abdominal rigidity with marked tenderness and rebound tenderness, more severe in the epigastrium and right lower abdominal quadrant. The white cell count was elevated. The serum amylase was within normal limits. A roentgenogram of the abdomen was negative. A diagnosis of perforated peptic ulcer high on the cardia was made.

On surgical exploration the abdominal cavity was found to contain a large amount of white fluid having the appearance of homogenized milk. The appendix was normal. The stomach, pylorus and first part of the duodenum were explored and no evidence of perforation or induration could be found. The lesser omental space was opened close to the pylorus and explored. The chylous-appearing fluid was retroperitoneal as high up as the diaphragm. The chyle extended retroperitoneally and to the right and had dissected between the sheaths of the mesentery. The duodenum appeared white and the chyle had dissected subserosally at the ligament of Treitz, giving the proximal 3 inches of the jejunum a milky-white color. The diagnosis of chylous ascites as a result of blockage and rupture of the thoracic duct was made. A drain was placed in the lesser omental cavity and in the pelvis. The pelvic drain was brought out through a small right muscle splitting incision.

The immediate postoperative reaction was good. The dysphagia disappeared and he was able to take fluids freely. Abdominal distention occurred and was relieved by a Levine tube and Wangenstein suction. For 2 days postoperatively the drainage from the abdomen was profuse and was chylous. On the third postoperative day it began to diminish and to become serosanguineous in character. The drains were removed on the eighth postoperative day and improvement was steady until his discharge on the thirty-ninth postoperative day. Repeated roentgen examinations of the chest and mediastinum revealed no pathologic condition. Barium meal studies showed no evidence of esophageal obstruction. The blood chemistry postoperatively was normal except for the proteins and albumin globulin ratios. The A/G ratio at one time was 0.5 of albumin to 1.0 of globulin, but was controlled by large infusions of plasma, amigen, and serum albumin. The patient was free from subjective and objective symptoms 9 months after his discharge from the hospital.

COMMENT

Cases of chylous ascites may be divided etiologically into three main groups. In the first group are those due to diseases which involve the lymphatics such as new growths, tuberculosis, filariasis, lymphomas, acute lymphadenitis, and thrombosis of the subclavian vein. In the second are those due to trauma; and in the third are those of spontaneous or unknown origin.

The absence of disease (the patient in good health 10 months later) and the lack of any history of trauma leads one to speculate that this case probably falls into the classification of spontaneous chylous ascites of unknown origin.

Several cases of traumatic chylous ascites in which the accident occurred several weeks prior to the onset of the ascites have been reported (1). It is possible that this case may have been due to trauma because this man had been actively engaged in athletics prior to the onset of his symptoms. Levering (1) in 1943, pointed out the rarity of traumatic chylous ascites (six reported cases) and its lower mortality rate in comparison with chylothorax. He also called attention to the report of Wyatt and Gross (2) who believed the diagnosis could be made roentgenologically because of the lowered radio-opacity of chyle, due to its high fat content. It is of interest to note that this finding could not be confirmed in a review of our films by our roentgenologist. The fluid aspirated from the abdomen fulfilled the specifications for chyle as outlined by Jahsman (3).

Conservative therapy seems justified and every effort should be made to maintain a normal blood chemistry by frequent laboratory studies and appropriate infusions. The albumin globulin ratio in this patient could only be maintained by large infusions of serum albumin.

SUMMARY

1. A case of chylous ascites of spontaneous origin is reported.
2. The clinical findings were similar to those seen in perforated peptic ulcer.
3. The convalescence was uneventful and complete recovery ensued.

REFERENCES

1. LEVERING, J. W.: Traumatic chylous ascites; case report. *Am. J. Surg.* 65: 434-436, Sept. 1944.
2. WYATT, G. M., and GROSS, R. E.: Chylous ascites; roentgenological observations from case in infancy. *Am. J. Roentgenol.* 45: 848-849, June 1941.
3. JAHSMAN, W. E.: Chylothorax; brief review of literature; report of 3 non-traumatic cases. *Ann. Int. Med.* 21: 669-678, Oct. 1944.



MEDICAL AND SURGICAL DEVICES



TWO METHODS FOR APPLICATION OF DDT IN THE FIELD

EUGENE R. HERING

Captain (MC) U. S. N.

and

JAMES F. GRIFFIN

Chief Warrant Officer (HC) U. S. N.

The prevention of disease among troops actively engaged in operations in the field has never reached a satisfactory level for two very obvious reasons. Regardless of the degree of training and discipline, the fighting man cannot take all the individual precautions indicated under the circumstances of battle, nor can any reasonable number of personnel devoted to sanitation and preventive medicine be expected to cope with the problem in the proximity of the front lines.

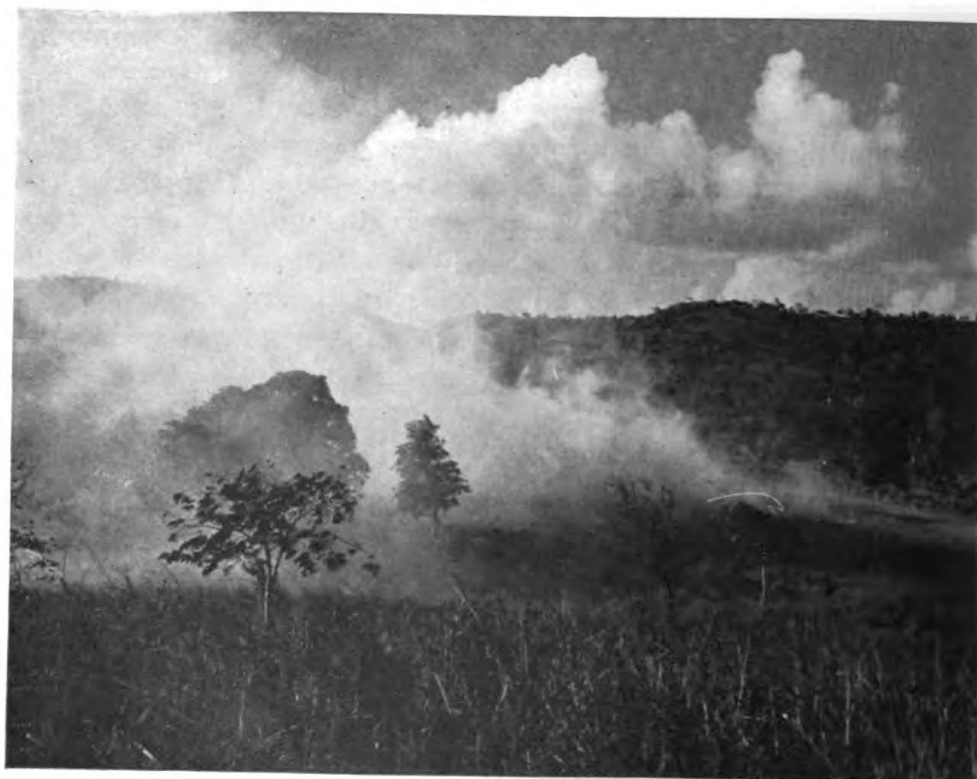
The advent of DDT gave the first hope that some real measure of protection against fly-, louse-, and mosquito-borne diseases could be given to the man who carries the burden of the fighting. There are still limitations, however, to the present means of employment of DDT. Airplane spray, while extremely necessary and effective, is not the complete answer. The plane is a very vulnerable target when employed in the front-line areas and the effectiveness is definitely reduced in mountainous terrain and where the foliage protecting breeding sites is heavy. Hand spraying for larval control takes more personnel than are usually available and is limited by the inaccessibility of large swamps. To supplement the use of DDT by the above methods, two further methods of DDT application were utilized on a recent maneuver in an effort to fill in the gaps not covered by plane and hand spray. These consisted of the use of a fog machine mounted on a 1½-ton truck for adult control and the use of power sprayer mounted on an M-29C "Weasel" for larval control in swamps and lagoons. It is to be emphasized that these methods are not to replace but to supplement other means of prevention of fly- and mosquito-borne diseases.

A brief description of the apparatuses follows.



—Official U. S. Marine Corps Photograph

Figure 1.



—Official U. S. Marine Corps Photograph

Figure 2.

FOG MACHINE

This mechanism consists of a commercial fog apparatus. It weighs approximately 700 pounds and is roughly 9 cubic feet in size. The machine plus 200 gallons of fog mixture are easily carried on a 1½-ton truck.

The fog mixture consists of a light grade of motor oil (approximately No. 10 S. A. E.) to which is added the DDT dissolved in xylene.¹ Three hundred and eighteen gallons of oil plus two hundred and twenty-five pounds of DDT dissolve in seventy-six gallons of xylene make four hundred gallons of the fog mixture (approximately 6 percent DDT). The fog dispenses in particles of 20 to 30 microns which is considered the optimum size for the purpose intended. One 55-gallon drum of this mixture will run the machine for approximately 1 hour and 40 minutes, and in the presence of a favorable wind of 5 to 10 knots will cover up to 5 or more square miles. The fog is quickly dispersed over a large area and no impairment of visibility persists. (See figs. 1 and 2.)

POWER SPRAYER

The power sprayer consists of a 6-horsepower, 4-cylinder gasoline motor with a hydraulic pressure pump, two nozzles, and necessary fittings.

The nozzles are set in the rear on each side of the "Weasel" and tilted slightly upward and to the rear. Each nozzle has a cut-off valve so that they can operate separately if the need arises.

This apparatus, together with a 55-gallon drum of 5 percent DDT in kerosene, was mounted in the rear seating compartment of an M-29 cargo carrier ("Weasel"). This vehicle was designed for the specific purpose of traversing water, swamps, and in general, types of terrain that precluded the use of wheeled vehicles. Possessing these characteristics, it lends itself admirably to conveying the sprayer through all types of breeding areas. At a speed of 3 miles per hour, using ⅞-inch nozzle apertures, the spray covers a path approximately 150 feet wide. At this speed, approximately 5 gallons of spray are dispersed per acre. (See figs. 3 and 4.)

While the apparatus gave good results in the breeding areas encountered on maneuvers, there were some specific defects noted, especially in regard to power output, nozzle design, and seating. The

¹ Since this article was received for publication, the transportation of xylene aboard naval vessels has been prohibited because of its low flash point. There are a number of commercial solvents available, however, which have a flash point well above the minimum accepted level for transportation aboard naval vessels. Such solvents work equally well in the fog machine and are capable of giving an even higher concentration of DDT in the fog produced.



—Official U. S. Marine Corps Photograph

Figure 3.

"Weasel" and the power-spraying apparatus are being turned over to the Naval Medical Field Research Laboratory at Camp Lejeune, N. C., for elimination of these defects, further testing as to capabilities, and for recommendations as to specific employment.

The efficiency of DDT applied in a fog for control of adult mosquitoes and flies is beyond question. During recent maneuvers, almost complete control was obtained in an area about that normally occupied by a division in combat, utilizing one machine and two operators. Landed early in the assault, this method of control could eliminate the infected mosquitoes up to and including the front lines providing the prevailing wind was favorable. In those areas where the terrain

reclused the use of wheeled transportation, the machine could be mounted in an amphibian tractor.

Larval control by use of 5 percent DDT in kerosene is also an established procedure. The advantage of mounting the power sprayer in a vehicle that can traverse practically any type of breeding area is obvious. Speed, economy of personnel, and coverage of areas otherwise inaccessible to a man on foot indicate that such an apparatus would prove invaluable in the immediate rear of the front lines.



—Official U. S. Marine Corps Photograph

Figure 4.

SUMMARY

Two methods for application of DDT in the field have been briefly described. Use on recent maneuvers has indicated that they are of value in supplementing other methods of DDT application and that with employment of a minimum of personnel, a high degree of fly- and mosquito-borne disease control may be obtained in the early stages of combat.



UROLOGY AWARD

The American Urological Association offers an annual award of \$1,000 (first prize of \$500, second prize \$300, and third prize \$200) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been in such specific practice for not more than 5 years and to residents in urology in recognized hospitals.

The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Biltmore Hotel in Los Angeles, May 16-19, 1949.

For full particulars write the Secretary, Dr. Thomas D. Moore, 899 Madison Avenue, Memphis 3, Tenn. Essays must be in his hands before February 15, 1949.



BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

PHYSICAL MEDICINE IN GENERAL PRACTICE, edited by Arthur L. Watkins, M. D., and 14 contributors. 341 pages. J. B. Lippincott Co., Philadelphia, Pa., Publishers, 1946. Price \$5.

In this valuable text, orientation is primarily toward employment of correct modalities of physical medicine in caring for various diseases and disabilities, rather than toward technical considerations. This is reflected in the titles of the various chapters which include, in addition to history, general factors, medical conditions, dermatology, minor injuries, fractures, orthopedic disabilities, and neurology. There is a special chapter on psychiatry in which occupational therapy is considered and also an excellent chapter on acute and convalescent poliomyelitis. Thus this book is particularly useful in the prescribing of physical medicine procedures and will help provide the general practitioner with a good idea of what can be expected from it.

The volume, however, goes beyond this and we find a most valuable chapter on Rehabilitation and Employment by Dr. George G. Deaver. The possibilities that can be exploited in this regard are enormous and will pay huge dividends not only in dollars and cents but in the salvage of personal self-respect and building of good morale for the patient. This is of enormous importance to the country, industry, and the medical profession, as well as the individual patient.

The organization of a Physical Therapy and Reconditioning Department as exemplified in Fitzsimons General Hospital is well discussed by Dr. O. Leonard Huddleston, and finally, there is an adequate chapter on the use of fever therapy.

In general we have here a very helpful book, eminently readable and very valuable both to the clinicians and to the specialists in physical

medicine. It should help to make physicians in general more aware of the virtues of physical medicine and less inclined to neglect this extremely beneficial field of medical practice. One would like to see it expanded by inclusion of a chapter or chapters on balneotherapy and the use of therapeutic pools and spas.

HANDBOOK OF TREATMENT AND MEDICAL FORMULARY, by Charles M. Gruber, Ph.D., M. D., *Professor of Pharmacology, Jefferson Medical College, Philadelphia, Pa.* 585 pages. F. A. Davis Company, Philadelphia, Pa., publishers, 1948. Price \$7.

This is a fine little handbook arranged alphabetically as to diseases and symptoms. The treatment given is plain and specific and also fully orthodox. There is a complete index of drugs with average doses in both metric and apothecary weights and volumes. Included are about 1,500 tried and true prescriptions written in both English and Latin. In the appendix is a table of vitamins and symptoms of vitamin deficiencies. The book has an attractive fabrikoid binding.

PSYCHIATRY IN A TROUBLED WORLD, by William C. Menninger, M. D. 636 pages. The Macmillan Company, New York, N. Y., publishers, 1948. Price \$6.00.

This book, by a distinguished American psychiatrist who was the chief consultant in neuropsychiatry to the Surgeon General of the U. S. Army, is a broad popular view of the mental disease problem as seen in our armed forces and civilian population during the war and afterward. Dr. Menninger draws many conclusions and makes a number of recommendations. He feels that the prevention of mental illness has been advanced by our experience. Many of the opinions expressed are certainly open to question, but this is to be expected when dealing with many controversial subjects.

THE ACUTE INFECTIOUS FEVERS, An introduction for students and practitioners: by Alexander Joe, D. S. C., M. D. (Ed.), F. R. C. P (Ed.), D. P. H., D. T. M. & H., *medical superintendent, City Hospital, Edinburgh; lecturer on infectious diseases to the University of Edinburgh; formerly medical superintendent, North-Western Hospital, London.* 276 pages; 64 illustrations. The Blakiston Company, Philadelphia, Pa., publishers, 1947. Price \$4.50.

The somewhat limited field described in the title is probably covered largely from the experience of the author. Some of the more febrile infectious diseases are omitted, as are the tropical fevers. The etiology, pathology, and clinical course of these diseases are adequately discussed. Considerable detail is devoted to the nursing care of the patient which is often very important in infectious diseases. This phase of the book clearly demonstrates the author's wide experience and sound judgment. It is true that some of the modes of treatment do not find wide favor in this country; however, this is hardly a major criticism of the book.

One defect which should be discussed is the omission of any reference to streptomycin and the sketchy reference to penicillin. It is true that in the field of therapeutics an article is almost outdated before it reaches the library shelves; however, in view of this the author of such articles or books should leave a little leeway for coming changes and possibly allow himself the pleasure of conjecture regarding new drugs. After all, advances in the use of new drugs are most properly made by men of experience who see an adequate number of cases.

To those of us who are accustomed to the voluminous references and pin-point indexing of American books these features appear somewhat meager in this volume. However, throughout the text there is evidence that the author is referring to the opinions of others as well as to his own experience. Ideally such a text should give as references, following each chapter, the few outstanding articles referring specifically to the subject of the chapter.

HISTOPATHOLOGY OF THE EAR, NOSE AND THROAT, by Andrew A. Eggston, B. S., M. D., *Director of Laboratories Manhattan Eye, Ear and Throat Hospital; Clinical Professor of Pathology (Post Graduate Division) New York University Medical College; director of laboratories of the Mount Vernon Hospital; pathologist, Harlem Eye and Ear Hospital; formerly associate in pathology, Vanderbilt University Medical School, and College of Physicians and Surgeons, Columbia University.* Diplomat of Pathology. 1080 pages; numerous illustrations. The Williams & Wilkins Co., Baltimore, Md., publishers, 1947. Price \$18.

This monumental book will undoubtedly serve as a standard reference book in otolaryngology. It contains a tremendous amount of information about embryology, anatomy, histology, and pathology of the ear, nose, and throat, which cannot be found in any other single publication. The numerous illustrations are well chosen. The bibliography is very extensive. The editing is not on a par with the scientific attainment of the author.

The first 485 pages are concerned with the comparative anatomy, embryology, histology, and physiology of the external, middle, and internal ear. A review of histopathology in general is given before the specialized pathology of the ear is dealt with. The discussion of allergy is especially interesting and informative.

The next 333 pages take up the comparative anatomy, embryology, histology, physiology, and pathology of the nose and paranasal sinuses. The diagrammatic presentation of the lymphatics of the nasal and sinus mucosa on pages 566 to 569 inclusive, are especially instructive. The discussion of neoplasms of the nose and sinuses is not at all exhaustive, but the important types are considered in detail, and the outline of tumors in general is very well done.

Pages 825 to 1053 deal with the pharynx and the larynx in the same manner that the previous sections cover the ear, nose, and sinuses. The discussion of lumps, swellings, or trumefactions of the neck in this section is especially well done.

This book should be made available to those naval hospitals which give approved residency training in otolaryngology.

GEORGE CRILE, AN AUTOBIOGRAPHY, edited with sidelights by Grace Crile. 2 volumes, 624 pages; illustrated. The J. B. Lippincott Company, New York, N. Y., publishers, 1947. Price \$10.

This is an interesting medical biography of one of the master surgeons of America who performed the first successful amputation under local anesthesia (in 1897), perfected nitrous-oxide anesthesia, and was a pioneer in research regarding surgical shocks and blood transfusion. He was one of the founders of the American College of Surgeons and the great clinic he established in Cleveland was one of the meccas of surgeons from every part of the world.

A Middle Western farm boy who went this far in fame and fortune could not but have an interesting life story. His wife who was his secretary, business advisor, and inspiration has edited the autobiography and added much to it that increases its value.

ARTHRITIS AND RELATED CONDITIONS, edited by Theodore F. Bach, M. D., F. A. C. P., *Associate in Medicine in the Graduate School of Medicine of the University of Pennsylvania*. 472 pages; 139 illustrations. F. A. Davis Company, Philadelphia, Pa., publishers, 1947. Price \$6.50.

This is an excellent and practical book. The diagnosis of the different types of arthritis are well described and the treatment given in a simple yet complete manner. An interesting feature are the home remedies recommended. Another point of importance is that the patient as an individual is considered rather than a knee or elbow joint, as is too often the case in dealing with the arthritic.

SURGICAL APPLIED ANATOMY, by Sir Frederick Treves, Bart., revised by Lambert Rogers, M. S. C., F. R. C. S., *Professor of Surgery, University of Wales*. 11th edition. 560 pages; 192 figures, 66 in color. Lea and Febiger, Philadelphia, Pa. 1947. Price \$6.

New and excellent edition of this classic.

RHEUMATISM AND SOFT TISSUE INJURIES, by James Cyriax, M. D., B. Ch. (Cantab), *Physician-in-Charge, Physiotherapy Department, St. Thomas's Hospital, London*. 410 pages; illustrated. Paul B. Hoeber, Inc., Medical Book Department of Harper and Brothers, New York, N. Y., 1948. Price \$9.50.

This work is devoted largely to soft tissue involvements, the diagnosis and treatment, with emphasis on physiotherapeutic measures.

AN INTRODUCTION TO DERMATOLOGY, formerly by Norman Walker, Kt., M. D., F. R. C. P., and G. H. Percival, M. D., Ph. D., *Grant Professor of Dermatology, University of Edinburgh*. 11th edition. 349 pages; illustrated. The Williams and Wilkins Company, Baltimore, Md., publishers, 1947. Price \$9.

Useful manual of skin diseases. Many good color plates.

STETHOSCOPIC HEART RECORDS, by George D. Geckler, M. D., *Associate Professor of Medicine, Hahnemann Medical College and Hospital*. Columbia Records, Inc., New York, 1947.

Whether or not an album of four 12-inch double-faced phonograph records is a "book" suitable for review in the BULLETIN's Book Notices is not yet certain, but it has been accepted as a book even though it contains little printed matter. The records are beautiful reproductions of normal and abnormal heart sounds and are of great teaching value. Cardiologist, general practitioner, or medical student can learn much from them.

PRIVATE ENTERPRISE OR GOVERNMENT IN MEDICINE, by Louis Hopewell Bauer, A. B., M. D., F. A. C. P. 201 pages. Charles C Thomas, Springfield, Ill., publisher, 1949. Price \$5.

This is an excellent little summary of the problem. Particularly good are the statements of deficiencies in American medicine and its chapter on "fact and fiction" about health conditions. A good deal of the latter is to be found in various places and Dr. Bauer's separation of the true from the false is excellent. Another feature is the review of medical systems in foreign countries and of compulsory and voluntary health insurance here and abroad.

CLINICAL STUDIES IN PSYCHOPATHOLOGY, by Henry V. Dicks, M. A., M. D. (Cantab), F. R. C. P. (Lond), *Nuffield Professor of Psychiatry, University of Leeds*. 2d edition. 238 pages. The Williams and Wilkins Company, Baltimore, Md., publishers, 1947. Price \$4.50.

A clear and concise introduction to the understanding of the psychoneuroses. Etiology and case reports with analysis are given particular emphasis. The importance of the anxiety neurosis and the favorable prognosis of this type is well brought out. The great increase of neurotic disease is due to the situations where the threat of obliteration is accompanied by the feeling of the helplessness on the part of the individual, and by the regimentation and loss of identity importance in large, unusual, and complex organizations.

An excellent little book.

MEDICINE TODAY, THE MARCH OF MEDICINE—1946. 177 pages. Columbia University Press, New York, 1948. Price \$2.

This is a collection of "lectures to the laity" sponsored by the New York Academy of Medicine. One of particular interest gives a short

history of research in the medical sciences. Some deal with the more controversial subjects of the distribution of medical care and facilities but all of them designed for popular information.

SYNOPSIS OF PEDIATRICS, by John Zahorsky, A. B., M. D., F. A. C. P., *Professor of Pediatrics*, and T. S. Zahorsky, B. S., M. D., *Instructor in Pediatrics St. Louis University Medical School*. 5th edition. 449 pages; 158 illustrations and 9 color plates. The C. V. Mosby Co., St. Louis, Mo., 1948.

SYNOPSIS OF PHYSIOLOGY, by Rolland J. Main, Ph. D., *Professor of Physiology, Medical College of Virginia*. 341 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$3.50.

SYNOPSIS OF ALLERGY, by Harry L. Alexander, A. B., M. D., *Professor of Clinical Medicine, Washington University School of Medicine*. 2d edition. 255 pages; 22 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$3.50.

SYNOPSIS OF OBSTETRICS, by Jennings C. Litzenberg, B. Sc., M. D., F. A. C. S., *Emeritus Professor of Obstetrics and Gynecology, University of Minnesota Medical School*. 3d edition, 416 pages; 157 illustrations including 5 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$5.50.

SYNOPSIS OF MATERIA MEDICA TOXICOLOGY AND PHARMACOLOGY, by Forrest R. Davison, B. A., M. Sc., Ph. D., M. B., *Assistant Professor of Pharmacology, School of Medicine, University of Tennessee*. 3d edition, 759 pages; 40 illustrations including 4 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$6.50.

SYNOPSIS OF OPERATIVE SURGERY, by John Mobley, M. D., F. A. C. S. 2d edition. 416 pages; 383 illustrations including 37 in color. The C. V. Mosby Co., St. Louis, Mo., 1947. Price \$6.

THE NATURAL HISTORY OF DISEASE, by John A. Ryle, M. A., M. D., F. R. C. P., *Professor of Social Medicine in the University of Oxford*. 2d edition, 484 pages. Oxford University Press, 1948. Price \$7.50.

OPHTHALMOLOGY IN THE WAR YEARS, volume 2, edited by Meyer Wiener, M. D., *Professor of Clinical Ophthalmology, Washington University School of Medicine*. 977 pages. The Year Book Publishers, Inc., Chicago, Ill., 1948. Price \$16.



PREVENTIVE MEDICINE

Captain Robert W. Babione, Medical Corps, United States Navy, in Charge



MASS PHOTOFLUOROGRAPHY IN A NAVAL SHIPYARD¹

MELVILLE J. ASTON

Captain (MC) U. S. N.

and

WILLIAM D. LOESER

Lieutenant, junior grade (MC) U. S. N. R.

The following observations and interpretations result from a follow-up study made 3 years after the initial photofluorographic screening survey of approximately 45,000 employees of the Norfolk Naval Shipyard, Portsmouth, Va. (1).

It is our purpose to examine the results of this mass photofluorographic survey and to follow up those persons still employed in this naval shipyard who still harbor lesions 3 years after the initial survey (table 1). It is anticipated that by this means some information may be gained regarding the value of such a survey and to compare the prognostic merits of roentgenography, clinical study, laboratory examination, and tuberculin testing. Furthermore, it is our hope that by such a study our findings will be of value in determining the pattern of a second photofluorographic study soon to be conducted here at the Norfolk Naval Shipyard (21).

The value of mass radiography and the need for its continued use has been established. Millions of people have been examined by means of mass radiography since the early days of World War II (2) (3). Reports of follow-up studies are meager and just what happens to the thousands of persons labeled as tuberculous is not clear (4).

Mass radiography as a case-finding measure is unsurpassed as a means of detecting unsuspected minimal tuberculosis. That there is a great preponderance of minimal tuberculosis found in surveys of this type is illustrated by the figures of Bloch who showed that as

¹ A large number of medical officers were engaged in the initial studies. They have all been separated from the Naval Service; therefore it is not now possible to name each officer and to suitably acknowledge his contribution.

high as 60 to 70 percent of cases so discovered are classed as minimal (5) (6). A further study illustrates the comparative effectiveness of mass photofluorography and the conventional chest clinic methods of individual physical examination and 14 by 17-inch chest roentgenogram. Two units operating in the same town give us an example (7). Of 5,325 mobile unit roentgenograms taken, 3.6 percent showed evidence of clinical tuberculosis, a total of 146 cases found by this method. Now, when this is compared with 500 initial visits to the health clinic, their case-finding method showed evidence of clinical tuberculosis in 8.8 percent and is thus more efficient. However, the number of cases totaled only 44. The high percentage of cases found by the chest clinic may be explained, in part, by the fact that persons who visit a chest clinic are usually contacts or suspects. Although the efficiency is over twice as high, the total number discovered is much less than by the mass survey method. In line with this, a more advanced type of lesion was found by the Health Department clinic.

TABLE 1

Middlesex, England, 34,227 cases		Norfolk Naval Shipyard, 45,000 cases	
	Cases		Cases
Cardiovascular disease.....	157	Cardiovascular disease.....	550
1. Congenital.....	12	1. Enlarged aorta, congenital.....	352
2. Acquired.....	¹ 145	2. Acquired.....	198
Tumors.....	15	Tumors.....	26
Bronchiectasis.....	31	1. Lung.....	10
Lung abscess.....	2	2. Mediastinum.....	16
Pneumoconiosis.....	33	Bronchiectasis.....	36
Pneumonia.....	10	Lung abscess.....	5
Bronchitis and emphysema.....	104	Pneumoconiosis.....	⁴ 39
Pleural thickening.....	569	Bronchitis and emphysema.....	229
Miscellaneous.....	158	Pleural thickening.....	439
Pulmonary tuberculosis, including healed.....	² 1,001	Pulmonary tuberculosis, including healed.....	⁵ 1,878
1. Known.....	140	1. Primary.....	1,476
2. New case.....	861	2. Secondary.....	⁶ 402
Active tuberculosis.....	³ 434		
1. Unilateral.....	275		
2. Bilateral.....	159		

¹ 86 percent knew of the lesion before examination.

² 2.92 percent healed.

³ 1.27 percent.

⁴ Includes 28 cases of silicosis.

⁵ 4.17 percent healed.

⁶ 0.89 percent of cases.

It is noteworthy that 80 percent of the new active cases found by the mobile unit were in the minimal stage, while of those discovered by the Health Department clinic 77 percent were in the advanced stages of the disease. It would seem, then, that in any given community it would be desirable to maintain both types of clinics: (a) one to study contacts and suspects (who will show a relatively high incidence of advanced tuberculosis); and (b) the mass survey which will reveal large numbers of unsuspected minimal tuberculosis. However, examination of contacts discovers as few as 25 percent of the new cases reported each year (6).

Mass radiography has revealed the incidence of tuberculosis as varying somewhat from group to group. Mass radiography by the Public Health Service and the Selective Service has shown that approximately 1 percent of apparently healthy individuals show lesions of pulmonary tuberculosis of which one-third to one-half are active or probably active. In contrast to these figures for selective groups of young individuals other surveys have revealed that from 3 to 4 percent have definite pulmonary lesions and that one-third to one-half of these are active (5) (11) (20), there being considerable variation between the several social and age groups.

Follow-up studies of mass surveys conducted in recent years are lacking. A solitary report in a near-vacuum of such studies concerns a repeat survey carried out in a large industrial concern in Cleveland, Ohio, 18 months after an initial survey (8). The important point brought out by this survey is that an appreciable proportion of cases of tuberculosis was missed in the routine reading of survey films. In comparing the two surveys it was found that of 97 cases that should have been detected in 1943, 20 were missed and of those reexamined in 1945, 10 cases were missed. The 1943 films of this latter group of 10 were available for comparison. However, in the 18-month period following the first survey, only 5 out of 3,926 nontuberculous individuals developed minimal reinfection tuberculosis. Such a low incidence would indicate that, provided errors in the initial survey were corrected and new employees are examined, a resurvey after an 18-month lapse would be of little value as a case-finding procedure. Britten (9) found a definite percentage of personal error in mass radiographic interpretation.

In contrast with this, follow-up studies of tuberculous persons discovered through methods other than the mass chest survey are numerous and pose some interesting problems. Myers' data (10) in Minneapolis for the 10-year period 1921 to 1931 showed that radiographic study had not revealed a single proved case of either primary or reinfection type of tuberculosis among nonreactors to tuberculin. It was considered relatively unimportant to make chest x-ray films of nonreactors to tuberculin in searching for tuberculosis but of great importance to make films of all adult reactors.

In the Minneapolis work, a considerable number of adult tuberculin reactors were seen who at first presented normal roentgenograms of the chest, but within a year showed evidence of moderately or far-advanced disease.

Figures that we have been able to obtain are in fairly good agreement that the incidence of the disease is approximately the same in the white and Negro races. However, because of a more rapid progression of the disease in the Negro the death rate is many times higher in that

group. The early lesions in the Negro progress into the advanced stages within a comparatively short period of time (5).

Of 25,000 Negroes examined by Bloch, 4 percent had lesions other than mere residuals of primaries and 2.6 percent had actually clinically significant disease. One and forty-three one hundredths percent of whites and nearly twice as many Negroes had clinically significant disease. Note that the total percentage of whites involved was actually higher (4.17) whereas the percentage of those involved to any serious extent was only one-half that of the colored. In general then, the total amount of involvement is not different in the two races but the disease tends to take a less favorable course in the Negro.

In studying age groups in relation to susceptibility to the disease, about 25,000 white males at the Norfolk Naval Shipyard showed in 1944 a relatively greater number of far-advanced lesions in the age group between 30 and 40 years, there being none between the ages of 14 and 25 (1). In a similar study conducted in England the greater numbers were between the ages of 25 and 44 years (21). In the younger age groups, females had a higher incidence than males; whereas the males had a higher incidence of clinically significant disease in the upper age groups.

On the other hand, pulmonary tuberculosis, when first diagnosed, is more advanced in the male. Metropolitan Life Insurance Company reports show that white male industrial policy holders had twice the mortality of similar white female policy holders (18). In brief then, apparently females are involved at an earlier age; males are more seriously involved when diagnosed.

When examination of chests was made by the Minneapolis workers, extensive disease was found in some cases within 3 to 6 months after clear chest films were observed (10). They state that apparently a few tuberculin reactors will have a more "rapid bronchogenic spread from an existing primary complex." This group was thought to be large enough to warrant semiannual roentgenograms rather than annual films. In the Minneapolis area the number of adults who react to tuberculin has become so small that such examination is practicable. However, Hilleboe (6) states that in large cities particularly the major portion of the adults are reactors to tuberculin and little is to be gained by tuberculin testing before roentgenography. The tuberculin test nevertheless was a most efficient tool in the differential diagnosis of tuberculosis after the screening roentgenogram.

As enthusiastic as these reports are, it was pointed out that actual diagnosis could only be made by other phases of the examination; that it was enough for the roentgenogram to supersede other investigative procedures in locating areas of disease. To attempt to determine the activity of proved tuberculosis lesions by a single roentgenogram is

labeled "preposterous." Reisner and Downs (12) do not agree, apparently. In their study of 469 cases observed for over 5 years after the initial roentgenographic survey, those lesions described as "exudative" and "exudative-productive" were characterized by an unstable behavior and a distinct tendency to progression, with evidence of activity in 50 percent of the whites and 61 percent of the Negroes. Those lesions described as "productive-fibrotic" and "fibro-calcific" did not show this tendency to progression. Hilleboe, in citing the work of Yershalmy, states that the discrepancies in the determination of activity and morphology of lesions among several expert roentgenologists were so great that the toss of a coin would have given about the same results.

Our follow-up studies 3 years after the original roentgenography are contained in a subsequent paragraph.

Calcification revealed by chest roentgenograms of nonreactors to tuberculin is almost never due to tuberculosis except in an undetermined percentage in whom all tubercle bacilli have died and the allergy has disappeared. The recent work of Aronson et al. (13), Palmer (14) (15), and Christie et al. (16), has revealed that in certain parts of the country, the long-suspected fungi are responsible for far more of the pulmonary calcium deposits than is the tubercle bacillus, at least in the areas where coccidioidomycosis and histoplasmosis is endemic. Furculow and coworkers (17) conclude that in regions where histoplasmin sensitivity is widespread, pulmonary infiltrations as well as calcifications are frequently nontuberculous and at present can be differentiated from tuberculosis only by skin tests.

Serial roentgenograms of lesions are helpful when tubercle bacilli cannot be recovered. Lesions that produce shadows thought to represent tuberculosis often prove to be due to acute infections which may disappear promptly; and in such cases films made 1 month later are usually clear. Infections of this kind were apparently responsible for 10 to 15 percent of the rejections for military service in World War II (10).

The futility of making a diagnosis of tuberculosis in the absence of a tuberculin reaction or a recovery of tubercle bacilli has been emphasized. The only results of the examination that give specific information are demonstration of a sensitivity to tuberculin and of the presence of tubercle bacilli. Evidence obtained through all other procedures permits only speculation.

The difficulties encountered in following an industrial group 3 to 3½ years after the initial survey are numerous. Many of those evidencing pulmonary lesions have left employment for personal or medical reasons. From a wartime peak of 42,808 persons there are now 10,070 people employed. As a result of the survey conducted

during the months between September 1944 and March 1945, 6,000 notations of pathologic conditions were made from the 35-mm. film (table 1). Forty-one thousand negative readings were recorded. Of the 1,476 primary tuberculous lesions and 402 secondary lesions only 46 cases considered clinically significant are now under the surveillance of the division of industrial medicine. The medical jackets of these 46 cases were reviewed and the results tabulated in table 2.

All patients were followed by the division of industrial medicine with roentgenographs at monthly to yearly intervals. Blood sedimentation rates, differential counts, and direct sputum smears were made routinely. All persons having pulmonary disease that could possibly be considered as clinically significant were referred to the local health department or to their personal physicians. Repeat roentgenograms and tuberculin tests were made by us in all 46 cases early in 1948. Tuberculin testing was carried out using the preparation "tuberculin P.P.D.," stock Navy material. Because we were dealing with supposedly known tuberculous persons it was deemed advisable to use only the small dosage of 0.00002 mg. (19). The readings represented the width of the area of induration of the forearm measured in millimeters 48 hours following the injection. All cases exhibiting any evidence of activity were classified into 3 groups, group 1 representing those with definite evidence of activity such as extension of a lesion roentgenologically, positive sputum or clinical evidence of active disease. Group 3 represents those with very indefinite findings including transient pleuritis, elevated blood sedimentation rates, doubtful roentgenographic evidence and vague symptoms. Group 2 includes the cases of intermediate activity.

The results are tabulated in table 2. It will be noted that of the 6 cases grouped in class 1 (definite evidence of activity) 5 showed a sensitivity to a small dose of tuberculin; of the 14 cases in classes 3 and 2, 9 gave a wheal of 4 mm. breadth or more from 0.00002 mg. of P. P. D., and of the 26 inactive case only 14 were positive.

Of 46 "tuberculous" cases studied 3 to 3½ years following an initial survey, 18 were not sensitive to a small dose of tuberculin. Of the 18 tuberculin-negative cases, 4 were diagnosed as pneumoconiosis by one or more observers. In the remaining 14 tuberculin-negative cases, 3 showed doubtful evidence of some activity assumed to be tuberculosis.

In the 20 cases exhibiting any extension of their lesions 14 were tuberculin-positive and 8 were thought to be probable candidates for activity in the original roentgenogram interpretation. Of the 6 cases in class 1 (5 tuberculin-positive) the original roentgenogram interpretation mentioned the possibility of activity in 4 cases and failed to indicate activity or future extension in 2.

TABLE 2.

Patient	Discovered Sept. 1944-Mar. 1945	Activity	Activity since discovery	Other conditions	Class	Tuberculin wheal	Original roentgenogram interpretation ¹
1. L. L. O., white male, age 51.	Yes	None	Degree of activity unknown Aug. 1947.		2	Negative	Inactive.
2. T. T. Negro male, age 50.	Yes	None				8 mm.	Old inactive.
3. A. W. S., white male, age 51.	Yes	None				Negative	Fibrosis.
4. H. B. M., white male, age 43.	Yes	None	Old pleuritis.			7 mm.	Tiny, inactive, fibrotic.
5. B. W. R., white male, age 48.	Yes	None	Emphysema.			7 mm.	Small, fibrotic.
6. E. W. L., white male, age 54.	Yes	None	Rales in apex in 1946 and subsidence of a lesion in 1947.	Pneumoconiosis.	2	9 mm.	Foggy.
7. L. E. R., white male, age 44.	Yes	None	Thorough study in January 1946, very doubtful.		3	11 mm.	Densely fibro-calcific.
8. C. K. G., white male, age 35.	Yes	None	Under treatment at clinic in 1945; slight extension in 1946.		1	5 mm.	Fibrous, chronic.
9. G. K. S., white male, age 47.	Yes	None				10 mm.	Questionable.
10. S. O. K., white male, age 53.	Yes	None				Negative	Very old, inactive.
11. P. R. H., white male, age 55.	Yes	None	Pneumoconiosis.			3 mm.	Probably active.
12. C. M. B., white male, age 35.	Yes	Not tuberculous.	Increase in extent and severity of tuberculous in 1944; not since.	Pneumoconiosis.	3	Negative	Probably inactive.
13. C. M. Mc C., white male, age 46.	Yes		Under care local physician in 1945. Activity doubtful.		3	Negative	No statement.
14. W. H. P., white male, age 50.	Yes		Possible extension in 1945 and 1947, roentgenogram. Under local physician. Night sweats.		2	7 mm.	
15. H. G. C., white male, age 39.	Yes						
16. J. W. B., Negro male, age 49.	Yes	Not tuberculous.	Pneumoconiosis.			7 mm.	Inactive, fibrotic, not healed.
17. M. W. B., white male, age 33.	Yes		Active tuberculous in 1945 with extension. Treatment with bed rest.		1	4 mm.	Fibro-calcific.
18. I. B. P., white male, age 54.	Yes		Slight progression on film of March 1948.		1	23 mm.	Slight fibrosis.
19. E. E. L., white male, age 51.	(?)		Roentgenologically active in October 1947; entirely gone by December 1947.		3	9 mm.	Active.
20. J. T. W., Negro male, age 48.	Yes		Regression of lesion in 1946. Active in 1945; bed rest.		1	9 mm.	Relatively inactive although not completely so.
21. C. P. S., white male, age 48.	Yes	None				Negative	Old inactive fibrotic.
22. E. B. J., white male, age 48.	Yes	None				Negative	Inactive and minimal.
23. O. J. D., white male, age 57.	Yes	None				5 mm.	Suspicious right apex.
24. H. O. C., Negro male, age 46.	Yes	None				10 mm.	Old fibrotic, inactive and minimal.
25. L. C., white male, age 48.	Yes	Not tuberculous.				Negative	
26. T. P., white male, age 28.	Yes	None	Obiteration of left costophrenic in 1946.		3	30 mm.	
27. B. P., Negro male, age 53.	Yes	None				8 mm.	

14- by 17-inch film.

TABLE 2.—Continued

Patient	Discovered Sept. 1944–Mar. 1945	Activity	Activity since discovery	Other conditions	Class	Tuberculin wheal	Original roentgenogram interpretation ¹
28. C. E. R., white male, age 38.	Yes	None				Negative	Primary tuberculosis, healed.
29. J. L. V., white male, age 30.	Yes	None	Gradual increase in fibrous markings left apex as of March 1948.		3	Negative	Inactive. Fibrosis very slight and doubtful.
30. E. T., Negro male, age 48.	Yes	None				15 mm	
31. H. A. T., white male, age 51.	Yes	None				Negative	Ghon's tubercle, no adult tuberculosis.
32. L. S. S., white male, age 59.	Yes	None				9 mm	Apparently well healed.
33. R. W. H., white male, age 50.	Yes	None				12 mm	Activity possible.
34. H. W. C., white male, age 54.	Known in 1944	None	Active in 1945		1	13 mm	Active roentgenologically and clinically.
35. E. S. T., white male, age 50.	Yes	None				7 mm	Minimal old fibrotic, probably inactive.
36. D. D. D., white male, age 34.	Yes	None	Not as extensive as in 1945; question of silicosis raised.		3	Negative	Old calcified primary focus plus pneumonitis in base.
37. W. L. V., white male, age 45.	Yes	None		Old pleuritis right base.		4 mm	Minimal fibro-calcific tuberculosis inactive; probably healed.
38. R. J. B.	Yes		One transient density noted in 1946.		3	4 mm	6-8 calcified lesions, primary. Tuberculosis healed foci.
39. R. L. V., white male, age 38.	Yes	None				Negative	Pneumonitis or interlobar pleural thickening. No tuberculosis. Stable.
40. S. H. L., white male, age 38.	Yes	None				Negative	Minimal tuberculosis; hilar enlargement.
41. J. L. F., white male, age 44.	Yes	None				Negative	Difference of opinion re activity.
42. S. C. C., white male, age 52.	Yes	None	Question of pleuritic process in 1946.		3	4 mm	Inactive; fibro-calcific.
43. B. L. B., white male, age 49.	Yes	None	Sanatorium 3½ months in 1945. No acid fast bacillus. No progression noted in roentgenograms.			Negative	Very old and inactive.
44. L. G. H., white male, age 32.	Yes	None	Clinically active originally; resolution in 1945. Degree of activity unknown, 1945. Slow progression 1945-47.		2	Negative	New, possibly active, lesion; also old lesions.
45. L. G. H., white male, age 43.	Yes				1	Negative	Not completely inactive.
46. G. W. C., white male, age 53.	Yes			Old pleuritis.	2	20 mm	Fibro-calcific shadows; also sparse lesions.

14- by 17-inch film.

CONCLUSION AND SUMMARY

1. The interpretation of the roentgenogram of a given case of suspected tuberculosis is useful in determining the presence of active disease but must not be counted on as being entirely accurate. In the 6 cases with definite activity reviewed and followed for 3 years, the original roentgenogram interpretation was accurate as to the activity in 4 and inaccurate in 2 cases. Of 22 cases having definite pulmonary lesions, but with no subsequent activity, the original interpretation of the roentgenogram was correct in 17, incorrect in 3, and indefinite in 2 cases.

2. Many persons under observation for tuberculosis for 3 to 3½ years were found to be tuberculin-negative to small doses. It is felt that the value of future surveys would be enhanced by inclusion of tuberculin testing of those patients screened by roentgenography both for diagnostic and investigative purposes.

3. The results of a mass photofluorographic survey conducted in 1944 are reviewed in tabular form.

4. Only 46 of 402 secondary cases are now under observation 3 to 3½ years after the initial survey.

REFERENCES

1. Unpublished data.
2. HILLEBOE, H. E., and HOLM, J.: Guide for disposition of persons with abnormal pulmonary findings on x-ray films. *Pub. Health Rep.* 61: 1759-1769, Dec. 1946.
3. HILLEBOE, H. E.: What is early tuberculosis? *Pub. Health Rep.* 61: 1295-1297, Sept. 1946.
4. OVERHOLT, R. H., and WILSON, N. J.: Silent and masquerading intrathoracic lesions; importance of proper identification of lesions discovered during x-ray surveys. *New England J. Med.* 234: 169-180, Feb. 7, 1946.
5. BLOCH, R. G., and TUCKER, W. B.: Indispensability of routine x-ray examinations of the chest in general clinic. *Am. Rev. Tuberc.* 50: 405-417, Nov. 1944.
6. HILLEBOE, H. E.: Community-wide chest x-ray surveys and the general practitioner. *Minnesota Med.* 30: 625-634, June 1947.
7. TURNBULL, R. B.; FARRIS, W. B.; and PATTERSON, M.: Tuberculosis case finding with mobile photoroentgenographic unit in Sumner County, Tenn. *Amer. J. Pub. Health* 36: 110-118, Feb. 1946.
8. BRITTEN, S. A.: Photofluorographic examination of chest of all Navy and Marine Corps personnel, 1944-1945. *U. S. Nav. M. Bull.* 46: 1479-1481, Sept. 1946.
9. MYERS, J. A.: Establishment and use of fundamental procedures in tuberculosis control. *Pub. Health Rep.* 61: 1563-1583, Nov. 1, 1946.
10. RAY, E. S.: Unsuspected tuberculosis. *Virginia M. Monthly* 73: 57-59, Feb. 1946.
11. REISNER, D., and DOWNES, JR.: Minimal tuberculous lesions of the lung; their clinical significance. *Am. Rev. Tuberc.* 51: 393-412, May 1945.

13. ARONSON, J. D. ; SAYLOR, R. M. ; and PARR, E. I. : Relationship of coccidioidomycosis to calcified pulmonary nodules. *Arch. Path.* 34: 31-40, July 1942.
14. PALMER, C. E. : Nontuberculous pulmonary calcification and sensitivity to histoplasmin. *Pub. Health Rep.* 60: 513-520, May 11, 1945.
15. PALMER, C. E. : Geographic differences in sensitivity to histoplasmin among student nurses. *Pub. Health Rep.* 61: 475-487, April 5, 1946.
16. CHRISTIE, A., and PETERSON, J. C. : Pulmonary calcification in negative reactors to tuberculin. *Am. J. Pub. Health* 35: 1131-1147, Nov. 1945.
17. FURCOLOW, M. L. ; MANTZ, H. L. ; and LEIVIS, I. : The roentgenographic appearance of persistent pulmonary infiltrates associated with sensitivity to histoplasmin. *Pub. Health Rep.* 62: 1711-1718, Dec. 1947.
18. Medical News: Wartime trends in tuberculosis. *J. A. M. A.* 122: 758, July 10, 1943.
19. MENENDEZ, F. J. : Tuberculin PPD; single intermediate dosage used in surveying 8,000 persons. *Am. Rev. Tuberc.* 53: 566-569, June 1946.
20. PINNER, M. : Pulmonary Tuberculosis in the Adult. Charles C Thomas, Springfield, Ill., 1945. p. 493.
21. DICK, W. P. : Mass miniature radiography of factory groups in Middlesex. *Brit. M. J.* 2: 568-569, Oct. 27, 1945.



BACILLARY DYSENTERY

RICHARD WILLIAMSON

Lieutenant Commander (MC) U. S. N.¹

ROGER FULLER

Lieutenant Commander (MC) U. S. N.

FREDERICK J. MARTIN

Lieutenant, junior grade (MC) U. S. N. R.²

and

HENRY TUCHEWICZ

Pharmacist's Mate, first class, U. S. N. R.³

Bacillary dysentery can be a serious menace to the functioning efficiency of naval vessels. This article records the observations made aboard a destroyer tender, a general repair ship, and a hospital ship which were present for 4 months during a bacillary dysentery epidemic involving certain fleet units in a large port of Japan. No shore-based naval personnel in the area were seriously affected.

This report is not a study of the original source of the epidemic. The destroyer tender entered the port early in October 1945, and the general repair ship early in November. At that time bacillary dysentery was already established aboard ships in the harbor. The ships were closely anchored and innumerable dysentery bacilli were

¹ Resigned.

² Inactive.

³ Separated from Service.

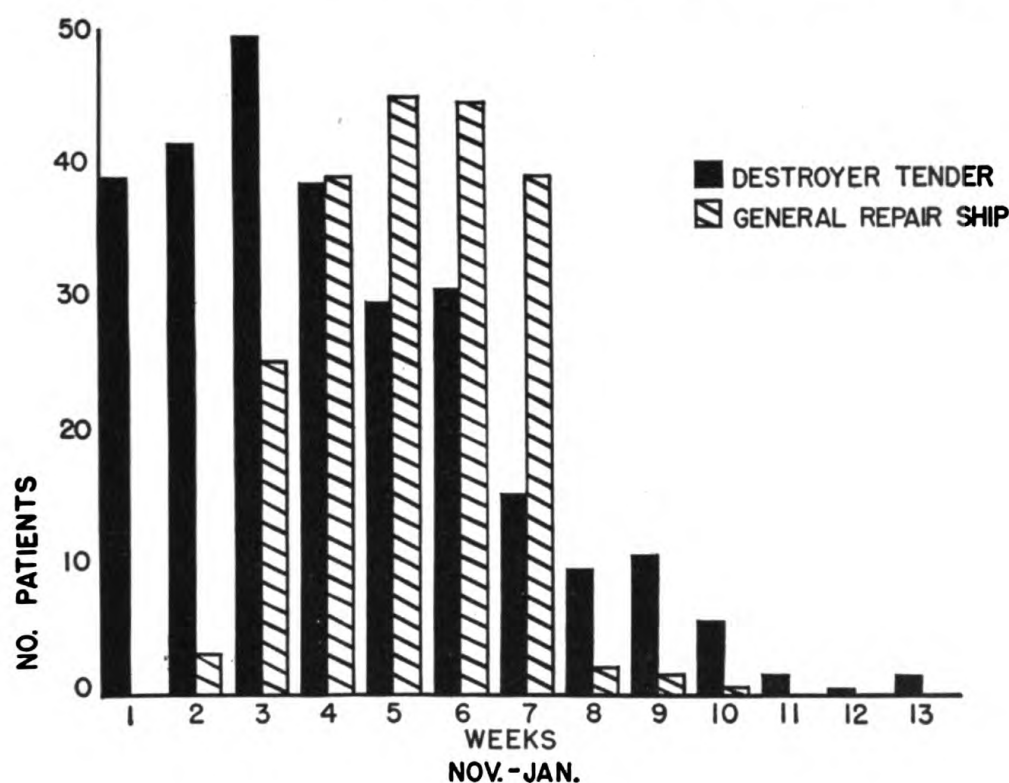


Figure 1.

undoubtedly being discharged with the ships' sewage into the harbor. Flies were present on all ships in small but significant numbers during October and November. On the general repair ship, the first cases appeared on 8 November 1945, 6 days after arrival. They were sporadic for a week. Then food handlers, who had not left the ship, came down with clinically recognized bacillary dysentery or were shown to be infected by routine stool culture although asymptomatic. The original cases had all been members of the large repair parties leaving the general repair ship daily. Several of these repair groups had worked on ships known to have bacillary dysentery aboard. At the time the food handlers came down with the disease, and for 3 to 4 days thereafter, a flurry of cases occurred among personnel who had not left the ship. Therefore it would seem that the first cases on the repair ship were infected while off the ship and that they brought the disease back to the ship. Weekly admissions due to dysentery are shown in figure 1 for the destroyer tender and general repair ship. Daily total of all dysentery cases in the harbor is shown in figure 2. Some factors which may have contributed to the downward slope of the curve of the epidemic are:

1. *A process of immunization.* On the destroyer tender, 48.1 percent of 300 new personnel who reported aboard 30 to 60 days after the ship had entered the harbor were admitted to the sick bay with bacil-

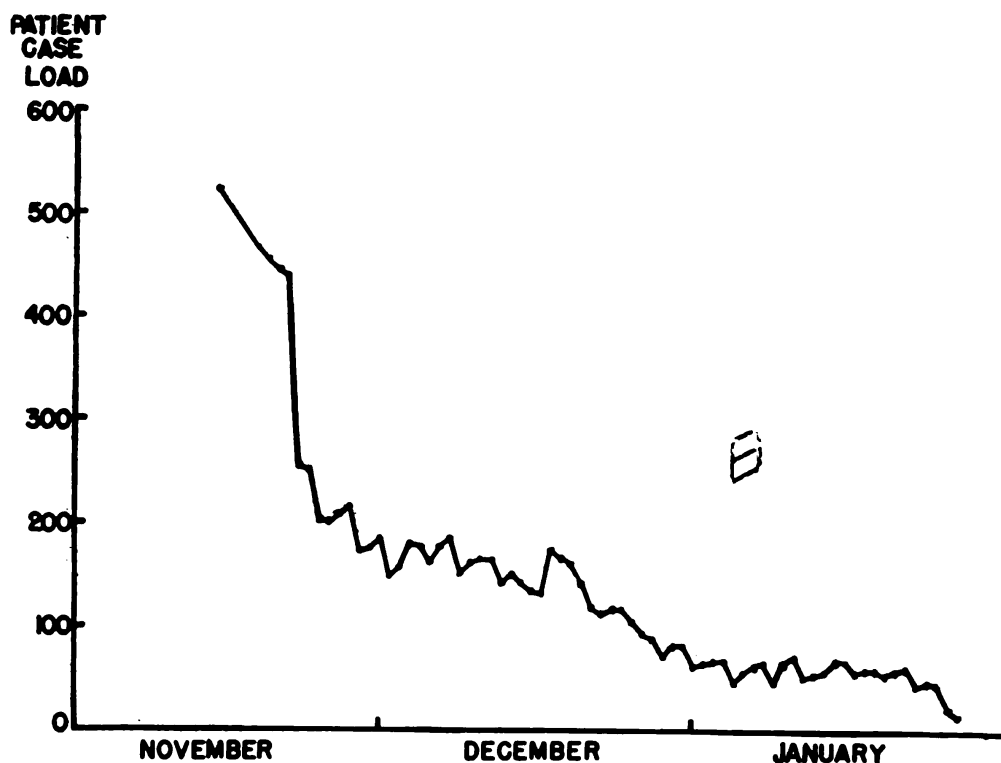


Figure 2.

lary dysentery. Of those who had been aboard since the ship entered the harbor, only 20 percent contracted the clinically recognizable disease. Furthermore, on the repair ship 8 of 16 food handlers were asymptomatic, although routine culture showed them to harbor dysentery bacilli. It would seem then that immunity was established among many more personnel than were clinically recognized as having had the disease.

2. *Departure of several ships.* The pool of infection was undoubtedly significantly decreased by the departure in November of several large ships having hundreds of cases aboard.

3. *Cooler weather and disappearance of flies.* The weather became much cooler and the fly population on the ships practically disappeared by late November.

On a hospital ship present in the harbor, 457 out of 1,608 cases stool cultured during October, November, and December, and January were declared positive for *Shigella paradysenteriae* by culture on S-S agar and Russell's double sugar media. In 35 of these cases the *Shigella* was carried through all diagnostic sugar media and agglutinations of the organism were made against all known types of bacillary dysentery diagnostic antisera. All 35 cases proved to be *Shigella paradysenteriae* (Flexner—type III). Several of the patients showed a high titer of agglutinins against pure cultures of Flexner III. The

stool cultures otherwise showed a few cases of salmonella infection and a few cases of amebic dysentery.

Rectal swab cultures of all patients on the repair ship were taken on sodium desoxycholate citrate agar. Suspicious colonies were agglutinated against the Flexner polyvalent (Types I-VIII) diagnostic antisera and cultured on Russell's double sugar media. Positive cultures for *Shigella paradysenteriae* (Flexner) were noted in 70 out of 230 cases. Agglutinations of all suspicious colonies against *Shigella dysenteriae* diagnostic antisera were also made and all were negative. The only other stool pathogens found were a few cases of salmonella.

It was thought that many more positive cultures would have been obtained if limited laboratory facilities had not made it impossible to culture in all cases before treatment had been started.

Clinically the disease was a mild form of bacillary dysentery. Case types were (1) asymptomatic, 8 of 16 food handlers on the general repair ship whose stool cultures were positive were asymptomatic, (2) having one or more intestinal signs and symptoms, (3) having one or more intestinal signs and symptoms and showing mild or moderately severe toxicity. No deaths were recorded. As usual, the disease was highly contagious and once established on a ship it spread quickly.

Sulfadiazine in doses of 2 grams stat., and 1 gram four times daily for 5 days or more was the treatment generally used. However, on the general repair ship 45 control cases were treated by supportive therapy only. The control cases were comparable with those treated by chemotherapy and 15 of the 45 control cases were proven positive for *Shigella paradysenteriae* (Flexner). The control cases responded clinically and bacteriologically as well as those treated by chemotherapy. All control cases exhibited negative stool cultures within 5 days after the onset of symptoms. The longest time any treated case was known to carry the *Shigella dysenteriae* was 14 days.

Prophylactic procedures such as were outlined in an excellent article on the prevention of bacillary dysentery aboard ship by Saunders⁴ were carried out. Furthermore, routine cultures of food handlers were done.

It is suggested that when a ship enters a harbor known to have bacillary dysentery present or when cases occur aboard ship, an organization plan already prepared, and which follows a program similar to that described by Saunders, should be actively and immediately carried out.

⁴ SAUNDERS, H. P.: Dysentery epidemic; report of 184 cases. U. S. Nav. M. Bull. 45: 1209-1211, Dec. 1945.



UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

NUMBER 6



NUMBER-DECEMBER

Bimonthly

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED P-112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

**Lt. (jg) Richard S. Farr (MC)
U. S. N., examining a specimen
with the electron microscope at
the U. S. Naval Medical Re-
search Institute, National Na-
val Medical Center, Bethesda,
Md.**

—Official U. S. Navy Photo.

Vol. 48

NOVEMBER-DECEMBER 1948

No. 6

UNITED STATES NAVAL MEDICAL BULLETIN

THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE



BIMONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriations Act for fiscal year 1949,
Public Law No. 753, approved June 24, 1948

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1948

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page ii for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the **Medical and Hospital Corps of the Navy.**

TRUMAN H. NEWBERRY,
Acting Secretary.



Because the supply of certain numbers of the **BULLETIN** is exhausted and because of the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated :

All numbers up to and including 1921.

Volume 16, 1922, No. 5.

Volume 17, 1922, No. 4.

Volume 18, 1923, Nos. 1, 3, and 5.

Volume 19, 1923, No. 3.

Volume 20, 1924, No. 5.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, No. 1.

Volume 26, 1928, Nos. 1 and 3.

Volume 31, 1933, No. 3.

Volume 42, 1944, Nos. 2 and 6.

Volume 44, 1945, No. 6.

March 1946 Supplement.

Volume 47, 1947, No. 6.

March-April 1948 Supplement.



SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$2.50; foreign subscription, \$3.25.

Single number, 50 cents.

Exchange of publications will be extended to medical and scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE



The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908, the Dental Corps in 1912, and the Medical Service Corps in 1947, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all officers of the Medical Department to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

CLIFFORD A. SWANSON,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS



Contributions to the **BULLETIN** should be typewritten, double-spaced, on plain paper of standard letter size and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions and the style laid down in the Government Printing Office Style Manual for spelling, abbreviations, capitalization, and the use of figures.

All pictures should be unmounted. Do not cut out portions of illustrations to be reproduced. Photographs should be black and white glossy prints, preferably 4 by 5 or 8 by 10 inches to allow for reduction. Do not make any marks on face of photograph nor type or write on back as these impressions show through and may mar the picture. Staples, paper clips, or pins should not be used on illustrations. All charts and graphs must be drawn with black India ink on white paper. If graph lines are to appear they should be in other than blue printing ink.

Contributions are to be the original work of the author and great care should be exercised to enclose in quotation marks quotations which may be introduced. Full credit for the source for these quotations should also be given. Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the **BULLETIN** should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

JOSEPH L. SCHWARTZ, *Editor.*
Captain, Medical Corps,
United States Navy.

TABLE OF CONTENTS



PREFACE	Page III
NOTICE TO CONTRIBUTORS	IV

ARTICLES

Plastic Repair of Surface Defects of the Lower Extremity—Otto W. Wickstrom	823
Massive Condylomata Acuminata—William N. New and William C. Marsh	831
Electrodiagnosis in Peripheral Nerve Lesions—Sam D. Graham	838
The Detection of Cancer Cells; Smear Technique—Kenneth P. Knudtson ..	843
A Technique for Alveolectomy—Frederick T. Wigand	847
Primary Mumps Meningo-Encephalitis; Review of Literature and Report of a Case—Kenneth P. Bachman	854
The Use of Hyaluronidase—Arvin T. Henderson, Stanley L. Wallace, and Ralph E. Faucett	865
Root Canal Fillings in Infected Pulpless Teeth; Preliminary Report—Norman B. Shipley	868
Toxicity of Local Anesthetics—John D. Walters	871
Acute Appendicitis Developing During Penicillin Therapy for a Suppurative Infection; Report of a Case—John R. Weisser and Alfred T. Wagner ..	879
Acute Appendicitis During Penicillin Therapy for Syphilis; Report of a Case—Marrin L. Gerber	881
Reactions From Penicillin With Case Report of One Fatality—Edwin E. Barksdale, Dwight M. Frost, and James J. Nolan	883
Delayed Reaction to Penicillin; Report of Four Cases—James L. Wells and W. P. Laird Myers	887
Benign Tumors of the Testis; Report of a Case—Spencer Johnson	893
Mumps Orchitis Treated With Reactivated Pooled Plasma; Report of Five Cases—Robert E. Huie, Jr	897
Glomus Tumor With Report of a Case—Ralph A. Downs, Jr	901
Epidemic Cerebrospinal Meningitis (Waterhouse-Friderichsen's Syndrome); Report of Two Successfully Treated Cases and One Fatal Case—Frederick W. Meyer, Jr	907
Occlusion of the Central Retinal Vein; Report of a Case Treated With Heparin—Robert C. Boyden and Harry A. Kettering	912
Simple Dislocation of the Talus Without Fracture; Report of a Case—Landes H. Bell	914

PREVENTIVE MEDICINE	
	Page
Venereal Disease Control by Punishment—Robert W. Babione.....	919
Pulmonary Tuberculosis; Experiences in a Naval Hospital—J. A. C. Gray..	921
The Health Services Program in the Trust Territory of the Pacific Islands— Frederick C. Greaves.....	925
CLINICAL CASE FOR DIAGNOSIS.....	941
EDITORIAL	
The Challenge of Cancer.....	948
NOTICES OF DEATHS OF OFFICERS IN MEDICAL DEPARTMENT..	950
BOOK REVIEWS	
Bell's Text Book of Pathology, Bell—An Atlas of Anatomy, Grant—Medi- cal Writing, Fishbein with assistance of Whelan—Understandable Psy- chiatry, Hinsie—Obstetrical Practice, Beck—Cineplasty, Kessler— Pharmacology, Therapeutics and Prescription Writing, Bastedo—Signs and Symptoms, 21 contributors; edited by MacBryde—Encyclopedia of Medical Sources, Kelly—Source Book of Orthopaedics, Bick—Minor Surgery, Christopher—Electrocardiography, Katz—Handbook of Com- municable Diseases, Top and 20 collaborators—Roentgen Diagnosis of Diseases of the Gastrointestinal Tract, Farrell—Exercises in Electro- cardiographic Interpretation, Katz.....	951
INDEX, Volume 48, 1948....	961
INDEX, March–April 1948 Supplement to the United States Naval Medical Bulletin.....	979



***U. S. Naval Medical Research Institute, National Naval Medical Center,
Bethesda, Md.***

ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO No.



19 November 1948

WASHINGTON 25, D. C.

Fellow Officers of the Medical Department:

Medical research in the Navy concerns itself with every measure applicable to the treatment and the prevention of disease, to hygiene, and to other problems in medicine common to civilian and military life. In particular, it embraces research in those problems that are distinctive to our present naval military organization. The variety of subjects covered is wide, but they are all intimately related, and their pursuit has as its sole aim and purpose the maintenance of the physical and mental welfare of naval personnel.

Some of the problems with which naval medical research is concerned at present are: acclimatization and tolerance to heat and cold; evaluation of military equipment from the standpoint of physiology; the toxicology of chemicals and explosives of military importance; the effects of X-radiation; causes and factors in the growth of epidemics; personnel psychiatric problems incident to combat; and the many other physical physiologic and neuropsychiatric problems pertaining to personnel. Many research projects have already been completed. Among these are: plasma storage; tantalum wire for suture material; effects of air blast on the nervous system and intra-abdominal organs; effectiveness of body armor; CO₂ and oxygen concentrations in submarines under operation.

The value of fundamental research is well recognized by this Bureau and it is the desire that Medical, Dental and Medical Service Corps officers with the requisite training and qualifications for work in medical research shall be given every encouragement and every opportunity to pursue this field in the Navy.

The broad scope of research requires that the work of the physician, the physiologist, the biochemist, the physicist, the chemist, the pharmacologist, the bacteriologist, the engineer and others be closely integrated. Such teamwork, with the utilization of the splendid facilities and equipment of our naval medical research units will bring many outstanding contributions and the solution to many important and intriguing problems in naval military medicine.

Sincerely,

A handwritten signature in dark ink, appearing to read "C. G. Swanson".

Rear Admiral, Medical Corps
Surgeon General, United States Navy

U. S. NAVAL MEDICAL BULLETIN

VOL. 48

NOVEMBER-DECEMBER 1948

No 6

ARTICLES



PLASTIC REPAIR OF SURFACE DEFECTS OF THE LOWER EXTREMITY ¹

OTTO W. WICKSTROM
Captain (MC) U. S. N.

RECONSTRUCTIVE surgery of the lower extremity involves many special problems. In a large number of cases there exist a loss of surface covering, bone, tendons, and nerves. To repair these defects the orthopedic, neuro- and plastic surgeons must have comprehensive knowledge of each of the associated specialties. Each must be able to evaluate properly the work of the other and accordingly plan the steps necessary to repair the defect.

The average wound can be closed primarily but there remain many avulsed defects where there is loss of skin and deep tissue, making ordinary closure impossible.

Where an adequate fat pad is present, the wound may be closed by means of a split-thickness skin graft. This simple method greatly reduces the healing time and may prevent extensive tissue loss.

If there is loss of deep tissue with exposed tendons, nerves, or bone, it is necessary to cover the defect with a flap containing skin, subcutaneous tissue and fat. Such a flap is planned to meet the needs of the area involved.

Flaps may be derived from areas either contiguous to the wound or may be obtained from a distance. A contiguous flap is made by undermining the skin adjacent or contiguous to the wound. By planned incisions the flap is transferred to cover the defect. This

¹ From the Department of Plastic Surgery, U. S. Naval Hospital, Great Lakes, Ill.



Figure 1a.—Chronic ulcer of 6 months' duration. Two attempts at skin grafting failed to heal this wound.



Figure 1b.—Ulcer covered with a contiguous transposition pedicle flap.



Figure 2a.—Soft tissue and bone defect of the right leg, the result of a bullet wound.—Appearance of wound on admission after 6 months of treatment.



Figure 2b.—Wound healed and covered with transposition flap. Skin graft to donor area.



Figure 3a.—Thin unstable scar, right hip.



Figure 3b.—Rotation flap from right flank replacing cicatricial tissue.

is accomplished by one of three methods: advancement, rotation, or transposition. (See figs. 1*a*, *b*, 2*a*, *b*, and 3*a*, *b*, and *c*.)

Nonunion of the tibia and fibula or femur with associated scar defects over the site of nonunion present special problems. In order to successfully graft bone the thin cicatricial covering over the area of nonunion must be excised and replaced with normal tissue. This flap should be sufficiently viable to permit operative procedures and provide proper nourishment for a bone graft. (See figs. 7*a*, *b*, and *c*.)

Osteomyelitis, after healing, frequently leaves a thin unstable covering that is constantly breaking down. Repair of these defects can seldom be made with adjacent tissue. Replacement is usually from a distance.

To secure flaps from a distance, a choice of several sites are available. This location is determined

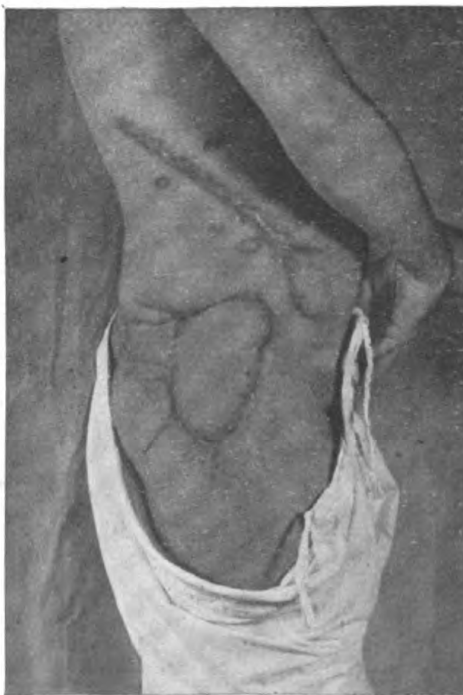


Figure 3c.—A heavy protective covering has replaced the thin scar.



Figure 4a.—*Soft tissue defect, lower left leg, the result of bullet wounds and osteomyelitis. Infection is in quiescent stage.*

by the position of the leg or thigh wound. The most commonly selected area is the medial surface of the opposite leg or thigh (figs. 4a, b, 5a, b, c, 6a, b, c, and 7a, b, and c). Pedicle tubes are frequently made on the inner surface of the same thigh and waltzed down to the defect. Occasionally it may be necessary to raise a tube on the abdomen, trans-



Figure 4b.—*Final stage completed; cross-leg pedicle flap has replaced friable, unstable scar.*

fer it to the wrist, and carry it down to the lower extremity. Flaps built on the opposite leg or thigh are transferred cross leg to the defect.

In order to insure an adequate blood supply the technique of delaying flaps is employed. This consists of outlining and undermining the flap or tube in stages. Each stage usually takes from 10 days to 2 weeks. The defect left by the raising of flap on the donor area is covered with a split-thickness skin graft. This procedure is performed at the time of the flap transfer. Figure 5b shows a healed donor area right leg covered with a soft, pliable, split-thickness skin graft. The muscles of the leg are protected from herniation by leaving the fascial layer intact.

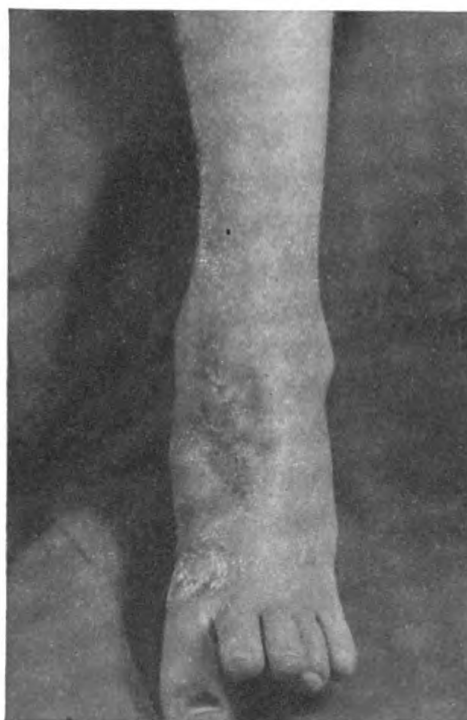


Figure 5a.—Unstable painful defect of dorsum of left foot, the result of shell fragment injury.



Figure 5b.—Scar defect replaced by cross-leg flap. The flap has been detached; donor and recipient areas healed, the donor area covered with healed skin graft.



Figure 5c.—Final result.



Figure 6a.—Necrosis of right os calcis with loss of one-half of heel bone.

upper third right leg. The fragment was removed successfully but was followed by infection and subsequent ulceration. The wound failed to heal in spite of two attempts to skin graft the area. A contiguous flap was raised in stages and transposed to cover the defect. The donor area was covered with a split-thickness skin graft. At the present time the wound is healed and the patient has been discharged from the service.

Case 2.—A marine, Pfc, accidentally shot himself in the right leg. The bullet produced a bone and soft tissue defect that failed to heal after months of treatment. There was no evidence of osteomyelitis. A contiguous flap was outlined medial to the wound and delayed. The wound was prepared by daily dressings of tyrothricin. After 2 weeks the scar tissue surrounding the wound was excised and the flap transferred to cover the defect. A split-thickness skin graft was used to



Figure 6b.—After healing of osteomyelitis of the os calcis, soft tissue replaced by means of a cross-leg flap.

A series of cases are presented to illustrate these procedures.

CASE REPORTS

Case 1.—This marine was injured on Kwajalein by a steel chip from a hammer. The chip lodged in the superficial tissues of the lateral surface



Figure 6c.—Soft tissue repair of right heel completed.

cover the donor area. The flap healed without incident and the patient has been discharged from the service.

Case 3.—During the invasion on Iwo Jima this patient was injured by shell fragment, causing a large hip defect. The thin scar tissue covering the defect was tight and constantly breaking down. A large pedicle flap was raised in stages from the flank and abdomen, using the inferior epigastric arteries for blood supply. The flap was rotated to cover the defect on the hip and the donor area closed primarily. As a result the patient has a heavy protective flap covering the upper end of the femur and the hip bones. Although ankylosis of the hip is present there is increased mobility of the soft tissues with marked improvement on walking.

Case 4.—This marine was struck in both legs by machine-gun bullets during the invasion on Bougainville. Osteomyelitis developed in the left leg and foot. After much treatment the infection subsided, leaving a large scar defect on the lower third of the leg and a cicatricial deformity on the foot. A large flap was raised in stages from the inner surface right leg. The scar tissue from the left leg was excised and the resulting defect covered by means of the cross-leg flap. The flap healed primarily and was detached in 18 days. At the present time the wound is completely stable and the deformity of the foot corrected sufficiently to permit normal walking.

Case 5.—This patient was injured on Iwo Jima when a piece of shell fragment struck his left foot. There was



Figure 7a.—Nonunion of tibia, inadequate cicatricial covering.



Figure 7b.—Cross-leg pedicle flap in position.



Figure 7c.—A heavy flap provides covering of bone graft.

fragmentation of bones and osteomyelitis developed. The fragment struck his left foot from above downward, producing a wound completely through the foot. After much treatment the wound healed. The center of the plantar surface was scarred and contracted, but adequate covering of the bottom of the foot was provided. The dorsum of the foot from the upper part of the ankle, measuring 2 by 2 inches, was covered by a dense adherent scar. This scar was thin and unstable. A pedicle flap was raised in stages from the inner surface of the right leg. The scar on the dorsum of the left foot was excised and replaced by this flap. At present the covering of the dorsum of the left foot is soft and pliable and function of the foot has been greatly improved.

Case 6.—This 23-year-old seaman, first class, was injured in an automobile accident, suffering a simple fracture of the right femur and a compound fracture of the left os calcis. The os calcis was secured in position by external fixation. After removal of all casts there was found to be a pressure sore over the dorsum of the right foot with an extensor tendon exposed, and a pressure sore on the same heel. The left heel showed an ulceration of the posterior and lateral surface with destruction of about one-half of the os calcis. After preliminary treatment and débridement of the wound the ulcer on the dorsum of the right foot was closed by means of transferring a contiguous flap. The donor area of the flap and the ulcer on the right heel were closed by skin grafting.

After 3-month treatment the osteomyelitis of the left heel subsided, and the defect covered by means of a cross-leg pedicle flap from the medial surface of the opposite leg. At the present time the flap is healing well and it is anticipated that the patient will shortly be completely ambulatory.

Case 7.—On Iwo Jima this Marine suffered a compound fracture of the left tibia and fibula from a mortar shell fragment. Nonunion and osteomyelitis resulted. The wound healed after much treatment leaving an unstable scar. In order to insert bone grafts it was necessary to replace the scar tissue with a heavy cross-leg pedicle flap. At the present time bone grafting has been successfully done and the patient is on the road to recovery.

SUMMARY

The repair of soft tissue defects of the lower extremity has been discussed with special reference to the use of the contiguous and cross-leg pedicle flaps.

REFERENCES

- MILLS, J. T.: Personal communication.
GREELEY, P.: Personal communication.
GREELEY, P.: Current experiences in plastic surgery among naval personnel. *Am. J. of Surg.* : 67: 401-411, Feb. 1945.
SHAW, D. T., and PAYNE, R. L., JR.: Repair of surface defects of upper extremity. *Ann. Surg.* 123: 705-730, May 1946.
RUBIN, L. R.: Contiguous skin flaps for wounds of extremities. *Am. J. Surg.* 71: 36-54, January 1946.



MASSIVE CONDYLOMATA ACUMINATA

WILLIAM N. NEW
Commander (MC) U. S. N.

and

WILLIAM C. MARSH
Commander (MC) U. S. N.

CONDYLOMATA acuminata have been fully reported and well discussed by various authors. Few physicians have trouble in making a correct diagnosis of condyloma acuminatum. The appearance of the bright red, moist, highly vascular, raspberry type of lesion, sessile or pedunculated and often friable, sometimes resembling a cock's comb or red-cauliflower mass, is well known.

These lesions have frequently been called venereal warts; however, this term is a misnomer. They are definitely not a venereal disease nor do they necessarily occur in conjunction with a venereal disease. The most common sites are the penis, scrotum, perineal and perianal areas, although they also appear on the buttocks, thighs, and even on the face.

The most common condition with which condyloma acuminatum might be confused is condyloma latum. History and examination of the patient together with a dark field examination for *Treponema pallidum* should serve to make the necessary distinction.

Treatment has varied greatly, and frequently was unsuccessful and usually slow. Such modes of treatment as the application of trichloroacetic acid or acid nitrate of mercury, fulguration, high voltage roentgen therapy, and even excision have been tried. Due to the multiplicity of lesions such methods were often difficult and anesthetics were frequently necessary.

From time to time lesions have been noted in the postcoronal sulcus despite the fact that the patient had been circumcised.

Following the report of Kaplan in 1942 (1) the use of podophyllin in the treatment of condyloma acuminatum has become widespread with practically 100 percent success.

According to the United States Dispensatory this derivative of the mandrake (also known as the May apple, ground apple, vegetable calomel and other less known names), contains an amorphous resinous substance, podophyllo-resin, which is chiefly responsible for its activ-

ity. It has previously enjoyed much favor as a cathartic; however because of its irritant qualities, it is gradually falling into disfavor.

It is said that during the war resourceful medical officers were able to separate the podophyllin from a well-known vegetable cathartic compound and used it to treat condyloma acuminatum.

The resin podophylli is a light brown to greenish yellow powder which turns dark when exposed to light or when exposed to temperatures exceeding 25° C. It is soluble in alcohol and in normal solutions of potassium or sodium hydroxide although it apparently becomes hydrolyzed.

Workers employed in the commercial preparation of podophyllin have been reported to develop a dermatitis and a severe conjunctivitis. Rosner (3) reports a case in which 25 percent podophyllin in mineral oil was used to treat "warts around the left eye" in which some of the preparation was inadvertently carried into the eye. This unhappy accident was followed by lacrimation, edema, photophobia, blepharospasm, and pain accompanied by formation of ulcers on the cornea. The latter eventually healed with very little disturbance of vision.

The mode of action has been assumed (4) to be a local irritation causing vascular spasm with resulting ischemia, necrosis, and sloughing. However, Sullivan and King (2) believe that podophyllin acts directly on the epithelial cells. They noted a direct degenerative effect accompanied by the production of bizarre cells which are now recognized as "podophyllin cells." The action is analogous to the effect of colchicine. They also noted, by contrast, that salicyclic acid and trichloroacetic acid produced only a simple fixing or coagulation effect on the superficial layers of the epithelium. Podophyllotoxin is easily susceptible to hydrolysis and these authors conclude by stating that since solutions of resin of podophyllum in sodium and potassium hydroxide proved inert when applied to condyloma acuminatum then the probable substance responsible for its cytotoxic effect is podophyllotoxin.

Podophyllin was used by Culp and Kaplan (5) in removing excessive granulation tissue from surgical wounds with dramatic success and they considered it far superior to silver nitrate in this respect. They did not indicate if the podophyllin had been applied more than once to the same area nor did they state whether or not any evidence of sensitization of the tissue had appeared.

Tomskey et al. (6) were able to obtain better results in treatment of cases of granuloma inguinale in which it was used. Their results, when compared with other types of treatment, show a larger percentage of improvement and a shorter duration of hospitalization.

Numerous reactions of the foreskin following the use of podophyllin in mineral oil are characterized by edema, redness, and superficial ul-

cers have been noted; however, statistics are not available as to the frequency of occurrence.

After searching for a vehicle which would not spread yet keep the podophyllin well in solution, the ideal seemed to be compound tincture of benzoin. The latter contains 77 percent alcohol which acts as the solvent and the constituents benzoin, storax, aloe, and tolu render it adhesive. No shaking is necessary in using this preparation as there is when the emulsion of podophyllin in mineral oil is used.

To reduce further the number of reactions obtained, it was decided to apply a thick coating of petrolatum over and around the lesions after they had been treated. By a thick coating is meant as much petrolatum as could be applied and still be able to reduce the foreskin over the glands. In the treatment of large lesions located on extra-genital areas strips of vaseline gauze were laid over the surrounding normal skin.

Care is necessary to spread the digitations of the verrucae in order to insure deeper penetration of the application yet it is essential to stop before the actual base is reached. Lack of care in this respect results in edema and much discomfort to the patient. Where opposing surfaces are present as on the uncircumcised penis and in the intergluteal folds these surfaces must be kept apart until complete drying has taken place, usually 15 to 20 minutes.

Some cases of phimosis have been reported in the literature which required dorsal slits. It was noted in these cases, however, that the verrucae had completely disappeared.

Should untoward reactions occur it might be advisable to use an anesthetic ointment; however, this was not necessary in our series of cases.

Seventy-five cases were treated with 25 percent podophyllin in compound tincture of benzoin, using the precautions as presented above. Complete eradication of all lesions was obtained. The majority, 78 percent, disappeared completely after the first application. The remainder required two or more applications. In only two cases were more than three applications necessary and these are reported here. The time between applications varied from 4 to 5 days.

CASE REPORTS

Case 1.—W. J. C.—A 19-year-old white male was admitted to the hospital with a large condyloma acuminatum in the right groin with 21 satellite lesions (fig. 1). The large condyloma measured 7.5 by 2.5 cm. and was raised 2.5 cm. from the skin surface. Growth of the large lesion had been noticed over a period of about 1 year.

Ten percent podophyllin in mineral oil was applied approximately every 5 days over a period of 40 days. Reduction in size was noted within 48 hours and all of the small lesions disappeared within 8 days. (See fig. 2.) After each appli-



Figure 1.—Case 1. Appearance of lesions. Note satellites.

cation of the podophyllin in oil the surface of the lesion became dirty grayish in color. When the lesion began to regain a pink color, more podophyllin was applied.

Despite the fact that this lesion was on an open surface and large quantities of vaseline gauze were used to protect the surrounding skin the patient suffered much discomfort and required analgesics from time to time because of the pain about the lesion apparently resulting from the spread of some of the podophyllin onto the surrounding normal skin.

Upon discharge from the hospital only a small, fibrous ridge remained at the site of the large lesion (fig. 3).

Case 2.—L. A. McL.—This 25-year-old white male entered the hospital with large perianal growths of several months' duration. He also gave a history of prolapsing hemorrhoids.

On examination he was found to have large, vascular, moist, verrucous

condylomata extending around the mucocutaneous junction projecting approximately 5 cm. from the base (fig. 4). Biopsy confirmed the diagnosis. Three small lesions were also present on the shaft of the penis.

On 28 June 1947 the first application of 25 percent podophyllin in compound tincture of benzoin was applied and the surrounding normal tissue was protected with a thick layer of vaseline gauze.

On 2 July 1947, 4 days later, it was estimated that approximately one-third of the verruca had regressed. The same preparation was again applied which resulted in further and equal diminution in size. (See fig. 5.)



Figure 3.—Case 1. Thirty-second day of treatment. The eighth and last application was necessary to remove the vestiges shown here. Only a small fibrous ridge remained.



Figure 2.—Case 1. Five days after application of 10 percent podophyllin in mineral oil. The second application was made on the fifth day, by which time all the satellites had disappeared.

The fifth application accomplished the total eradication of the lesion. The proctologist examined the patient and reported that only minimal hemorrhoids existed and these did not require surgery.

The patient suffered relatively little discomfort as there was little irritation of the surrounding tissue. He was given mineral oil during the treatment to eliminate the possibility of any discomfort which formed or hard stools might have caused.

It was found convenient in his case to tape the buttocks back to facilitate drying of the application and it was felt that leaving the tape on would reduce the possibility for normal skin to come into contact with the treated area. For the last three applications this was not necessary and vaseline was simply placed over and around the recently treated lesion.

Sedation was necessary for 24 hours following the first and second applications but was not necessary subsequently.

The patient was ready for discharge from the hospital on 20 July 1947, a total of 22 days under treatment.

Case 3.—J. J. A.—A white male, age 30 years, had condylomata acuminata which first developed in 1944 with relatively slow growth at first. There had been a rapid increase in growth during the past year. Examination showed a rosette arrangement of condylomata around the postcoronal sulcus with four large and one small one on each side of the frenum.

Approximately one-third of the condylomata were treated with podophyllin 25 percent in compound tincture of benzoin, followed by a thick coating of vaseline after the solution had dried. When the patient was seen 5 days later the treated verrucae had almost completely disappeared.

Podophyllin was again applied to all lesions, and as before, vaseline was applied in a thick coating after the solution had dried.

He returned the next day with an edematous and reddened foreskin with paraphimosis. The patient stated that when the podophyllin was applied the

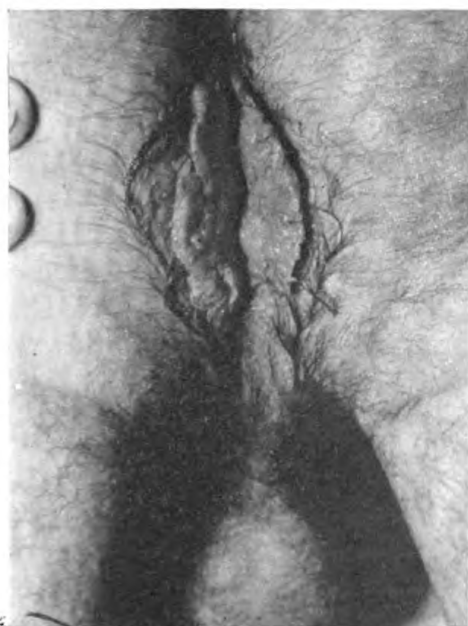


Figure 4.—Case 2. Appearance of the massive condylomata before treatment.



Figure 5.—Case 2. Appearance just before the last application of 25 percent podophyllin in compound tincture of benzoin. Only a very small remnant appears and this disappeared 3 days later.

first time there had been some burning and swelling but when the second application was made there was immediate burning and with swelling enough to prevent extension of the foreskin over the glans.

After 4 days of alternate cold water and magnesium sulfate soaks the patient was able to reduce the paraphimosis. The remaining redness disappeared in 2 days.

HISTOPATHOLOGY

Biopsy of the lesion in case 1 was reported as follows by Dr. Fred Weidman.

The specimen was bisected; the plan of architecture of condyloma acuminatum is exhibited better in one half than in the other. In this one, a broad area of young fibrocellular tissue appears, richly vacularized and containing several smaller and larger regions of lymphocytic infiltration. But few polymorphonuclears are intermingled. From this region, finger-like projections of the same kind of fibrous tissue extend more or less radially, with branchings and subbranchings. Naturally, some of the latter are sectioned transversely or obliquely, in addition to longitudinally.

Over such fibrous cores, a thick layer of epidermis is projected. The normal plan of stratification is well maintained; it is easy to distinguish basal, prickle, granular and corneous layers, and without any disturbance of the layering. The prickle cells are swollen and associated with beautifully exhibited intercellular edema. The stratum corneum, although dense, is not thickened in proportion to the mass of epidermal cells as a whole, and thus points against verruca vulgaris.

This patient had been treated with podophyllin. The so-called podophyllin cells appear in various form. Most of them are uninuclear, but are large and exceedingly rich in chromatin; so much so, in fact, that the nucleus is solid. A clear space occurs around such nuclei, whatever its significance may be. Evidence of rapid cell division appears frequently, in the form of cells which have two nuclei. Frequently, mitotic figures appear, but it is not possible to count the number of chromosomes in this preparation, nor in sections stained by Giemsa.

COMMENTS

Of 75 cases treated only 1 case required hospitalization for an untoward reaction and this case is reported. This case also serves as further proof that podophyllin is not only a primary irritant but also a grade 1 sensitizer as reported by Sullivan and King (2).

None of our cases was instructed to wash off the treated surface after a certain period of time. In the case reported it is evident that this patient washed off the medication as well as he could when the area treated began to itch and burn, approximately 2 hours after the second application of the drug.

From a review of the articles listed in the references it would seem that podophyllin will work efficiently in organic and inorganic oils, water-soluble bases, and alcoholic solutions. A few cases were treated by using podophyllin in Intraderm solution. No advantages were discerned and a return to the use of the readily available compound tincture of benzoin was made.

Shaking the emulsion of podophyllin in mineral oil is essential when using that preparation but not necessary when the solution of podophyllin in compound tincture of benzoin is used. This might possibly be a factor in a busy clinic.

The bizarre cell forms noted by Sullivan and King seem to be a constant finding and it is probably true that podophyllin acts by causing degenerative changes in the epithelial cells of the condyloma.

SUMMARY

1. Two massive condylomata were successfully treated with podophyllin.
2. Care must be used in repeated applications of podophyllin to the same area because of the evident tendency of the drug to produce a marked local sensitivity.
3. Compound tincture of benzoin in our hands has been shown to be a vehicle admirably suited to carry podophyllin and retain it where used.
4. Further evidence is presented which confirms the fact that podophyllin acts directly on the epithelial cells.

REFERENCES

1. KAPLAN, I. W.: Condylomata acuminata. New Orleans M. & S. J. 94: 388-390, Feb. 1942.
2. SULLIVAN, M., and KING, L. S.: Effects of resin of podophyllum on normal skin, condylomata acuminata and verrucae vulgares. Arch. Dermat. & Syph. 56: 30-47, July 1947.
3. ROSNER, R. S.: Corneal insult from podophyllin. Am. J. Ophth. 29: 1448-1450, Nov. 1946.
4. REICH, W. J.; NECHTOW, M. J.; and RUBENSTEIN, M. W.: Podophyllin treatment of soft papillomas of female urethra. Am. J. Obst. & Gynec. 53: 658-662, Apr. 1947.
5. CULP, O. S., and KAPLAN, I. W.: Condylomata acuminata, 200 cases treated with podophyllin. Ann. Surg. 120: 251-256, Aug. 1944.
6. TOMSKEY, G. C.; VICKERY, G. W.; and GETZOFF, P. L.: Successful treatment of granuloma inguinale, with special reference to use of podophyllin. J. Urol. 48: 401-406, Oct. 1942.



ELECTRODIAGNOSIS IN PERIPHERAL NERVE LESIONS

SAM D. GRAHAM

Lieutenant, junior grade (MC) U. S. N. R.

SINCE World War II the number of peripheral nerve lesions seen has decreased markedly. Before the war, peripheral nerve lesions were sufficiently infrequent, as noted by Davis (1), so that no one individual was able to gather enough personal cases to make a thoroughly profitable clinical investigation. During wars the number of peripheral nerve lesions becomes great and much of the knowledge gained is from the examination of these wartime series.

There has been a great need for a test or tests to determine whether a nerve is degenerating, has degenerated, or is regenerating. Also there is a need for tests to help differentiate between paralysis of a motor nerve of central origin and that of peripheral origin.

Erb (2), in 1868, first described the reaction of degeneration. This required the use of both faradic and galvanic current and was not too accurate in following the state of innervation. In 1917, Adrian (3) said that "as far as relevant diagnosis and prognosis is concerned, no advance has been made since Erb's first work." World War II gave new impetus to the field of electronics to produce a machine which would give accurate and reproducible data, expressed in terms of physical quantities on the condition of peripheral nerves. Several machines were developed and have been used experimentally and clinically with good success. A constant current impulse stimulator (4) has been used by the writer, although there are some other machines that are adequate.

In his description of reaction of degeneration, Erb set forth certain observations, and some of them continue to hold even with the newer methods of diagnosis. He noted that there was an increased irritability of the nerve to galvanic and faradic current for 2 to 3 days and then the irritability of the nerve decreased to both types of current until it was completely lost. There was a loss of faradic irritability of the denervated muscle, but an invariable increase in galvanic excitability of the muscle beginning the second week and lasting as long as 2 months. Another observation was that the muscle showed sluggish contraction to galvanic stimulation following section of the nerve and occurring at various times following section. The anodal closing contraction (ACC) becomes not only as great as the cathodal closing contraction (CCC) but in most cases considerably greater.

Clinically it has been found that the nerve will not respond to stimulation after it has been severed for several days. There is an increased irritability of the denervated muscle in man to constant direct current (galvanic). This irritability does not disappear for 2 months or longer. The slow or wormlike contractions of the muscle are not seen until several weeks after the severance of the nerve in man. The fact that ACC becomes as great as the CCC, and in some cases even greater, is not constantly seen in man but is of interest if present.

Certain terms have been adopted in electrodiagnosis and by determining these various data the state of the nerve can be determined. (*a*) Rheobase is defined as the minimal current, which will stimulate muscle or nerve, flowing for infinite duration. (*b*) Chronaxia is the current duration at which the strength of the current necessary to produce contraction of the muscle by a current of infinite duration is doubled. (*c*) The strength duration curve is obtained when one plots the strength of the current necessary to produce contraction of the muscle against the duration of the current. As the duration of the stimulus is shortened, so must the strength of the current be increased. (*d*) Tetanus ratio is the ratio between the amount of current necessary to produce tetanus and that necessary to produce rheobase.

In the physical medicine department in which our patients were seen and tested, the following data were obtained and thereby the state of innervation could be determined: (*a*) History of length of time since injury and the site of injury; (*b*) CR or rheobase; (*c*) AR; (*d*) chronaxia; (*e*) strength duration curve; and (*f*) tetanus ratio and galvanic tetanus. A muscle innervation chart is referred to constantly because it is difficult to remember the innervation points of the muscles. These charts are not too accurate and the point of innervation of each muscle must be accurately determined by moving the exploring electrode around the area of innervation until the point taking the least amount of current to cause contraction of the muscle is located. The tests are repeated every 10 to 14 days until recovery has taken place or until the patient is discharged. The majority of the patients seen had had their injury some months previous to the first examination and in none was degeneration present. A few cases, because of the absence of a history of trauma, have been diagnostic problems in determining if the lesion was central or peripheral in origin.

In testing for rheobase with the constant current impulse stimulator (*5*), the infinite time is taken to be 0.5 second. The normal rheobase varies for each muscle. When a nerve is severed, the rheobase after a few weeks becomes less than normal and remains low for 1 to 3 months, depending on the length of the distal segment. As regeneration takes place it becomes very high. Then the amount of

current necessary to produce a contraction slowly declines until it reaches normal. In most cases seen in this department, the rheobase was low (0.5 to 1.5 milliamperes) when the patient was first seen with the normal side two to eight times as high. In three cases the minimal amount of current necessary to produce contraction was so high that it could not be determined. Either because the patient could not stand the high current, or it took more than 25 milliamperes (extent of meter calibration). One of these three cases was discharged before continued studies could be done. The others have shown a decline in the rheobase with later clinical signs of return of innervation.

The chronaxia is of importance at the first examination but is of little value in following regeneration (6). The chronaxia increases soon after injury, but then decreases temporarily only to rise again to a high peak. The normal chronaxia is less than 1 millisecond and in the denervated state may rise as high as 100 milliseconds. After regeneration has begun and other electrical signs show regeneration, the chronaxia begins to fall fairly rapidly. It may not fall until after motor recovery is present. With a history of injury several months previous to the original examination, as in most of our cases, a moderate chronaxia is taken to be a sign of recovery. If the history is short and the chronaxia is over 15 milliseconds, then degeneration or denervation is probably present. In our cases the chronaxia varied in height up to 40 milliseconds. The patients who so far have shown a complete return of innervation have shown a drop in the chronaxia to normal. However the chronaxia remained high long after other signs showed regeneration.

The tetanus ratio is of great aid in the diagnosis of the state of innervation. Erb (2) pointed out that in the denervated muscle, instead of the normal short lightning-like contraction seen in the normal muscle, there is a slow, long-drawn contraction occurring which passes into a continuous tetanus lasting the duration of the relatively feeble current. With the newer equipment, a rectangular wave current lasting 1.5 seconds can be obtained and used in determining the tetanus. The minimal amount of current flowing for 1.5 seconds that causes a contraction is determined and then the amount of current flowing for the same length of time causing tetanus of the muscle is found. A ratio between the two is called the tetanus ratio. A normal ratio is 4.0 or 4.5 to 1 (7). In experimental work, Pollock, Golseth, and Arieff (8) (9) found in the denervated state in cats that the ratio approached unity, but in man the ratio, although low, was never unity.

The minimal threshold for galvanic tetanus aids in diagnosis as well as the tetanus ratio. A moderately high threshold for galvanic tetanus and a high tetanus ratio are signs of degeneration. A low

galvanic tetanus threshold and a low tetanus ratio are characteristic of denervated muscle. A high threshold for galvanic tetanus and a very high tetanus ratio are signs of regeneration. We have not seen a tetanus ratio that approached unity. The lowest found was 2.5 to 1, but these increased later. We have seen some very high galvanic tetanus and tetanus ratios in early regeneration.

The strength duration curve is probably one of the main diagnostic aids in peripheral nerve lesions. Adrian (10) observed that curves obtained by plotting the relation between strength and duration of the current necessary to excite muscle during degeneration and regeneration of its nerve supply are complex. These are not the simple curves seen in normal muscle or those in the denervated state. Pollock, Golseth, and Arieff (11) have confirmed this work of Adrian's. They showed that these curves, plotted on a logarithmic scale, follow certain characteristics. In degeneration and regeneration the curves are not smooth but show discontinuities. The curve of normal muscle is flat and smooth and the curve of denervated muscle is steep and smooth. All of our cases have shown discontinuities at the time of the original examination and these have continued to be irregular. For this reason the fact that most of the injuries had occurred several months prior to the examination, they were considered as regenerating.

DISCUSSION

If the history of the time of injury is less than 1 or 2 months and the patient on examination shows a low rheobase, a moderately high galvanic tetanus threshold, a high tetanus ratio, a chronaxia above 15 milliseconds, the AR slightly greater than the CR, and discontinuities of the strength-duration curve, one can say that degeneration is taking place. The patient should be followed at 10- to 14-day intervals to see if regeneration is going to take place. If the nerve has been severed and repaired, regeneration does not appear by electrodiagnosis for at least 50 to 60 days.

If there is a denervated state, one will find a low to normal rheobase depending upon the length of time since the injury, a low galvanic tetanus threshold, a low tetanus ratio, a smooth steep strength duration curve, and the relationship of AR to CR varying. Such patients should be followed for the possibility that regeneration may subsequently take place. In severed nerves which have been repaired, one will see the picture of degeneration for 50 to 60 days. For a short while it is that of denervation, then signs of regeneration will appear. If a nerve has been damaged and signs of denervation persist then the patient should be explored surgically.

In regeneration one will see a normal to a high rheobase, a high galvanic tetanus threshold, a very high tetanus ratio, AR greater

than CR, and discontinuities of the strength duration curve. The chronaxia may be very high when the patient is seen but as regeneration takes place, it will fall to normal. If there has been no repair of the nerve and the length of time since the injury is sufficiently long enough to expect the denervated state and the above signs are present, then one can say that the nerve was only partially severed or injured.

CONCLUSION

1. The newer electrodiagnosis machines, with their rectangular wave galvanic current giving accurate reproducible data, have become a great aid in diagnosing and following the course of degeneration, denervation, and regeneration.

2. Many of Erb's original findings in his "reaction of degeneration" are still used in testing for nerve lesions, although his findings have been elaborated upon.

3. Certain characteristics for degeneration, denervation, and regeneration have been outlined and have been used to follow the state of innervation with good success.

REFERENCES

1. DAVIS, L. E.: Principles of Neurological Surgery. 2d edition. Lea & Febiger, Philadelphia, Pa., 1942. p. 335.
2. ERB, W.: Deutsches Arch. F. klin. Med. 4: 535, 1868.
3. ADRIAN, E. D.: Arch. Rad. & Elec. 21: 54, 1917.
4. GOLSETH, J. G., and FIZZEL, J. A.: Constant current impulse stimulator. Arch. Phys. Med. 28: 154-158, Mar. 1947.
5. POLLACK, L. J.; GOLSETH, J. G.; ARIEFF, A. J.; and MAYFIELD, F. H.: Electrodiagnosis by means of progressive currents of long duration; studies on peripheral nerve injuries in man. Surg., Gynec. & Obst. 81: 192-200, Aug. 1945.
6. POLLOCK, L. J.; GOLSETH, J. G.; and ARIEFF, A. J.: Changes in chronaxie during degeneration and regeneration of experimentally produced lesions of sciatic nerve of cat. Surg., Gynec. & Obst. 81: 451-454, Oct. 1945.
7. ZANIEWSKI, J.: Wien. Klin. Wchnschr. 28: 205, 1915.
8. POLLOCK, L. J.; GOLSETH, J. G.; and ARIEFF, A. J.: Galvanic tetanus and galvanic tetanus ratio in electrodiagnosis of peripheral nerve lesions. Surg., Gynec. & Obst. 81: 660-666, Dec. 1945.
9. POLLOCK, L. J.; GOLSETH, J. G.; MAYFIELD, F.; ARIEFF, A. J.; and LIEBERT, E.: Spontaneous regeneration of severed nerves, J. A. M. A. 134: 330-333, May 24, 1947.
10. ADRIAN, E. D.: Physiological basis of electrical tests in injuries. Arch. Radiol. & Elec. 21: 379, May 1917.
11. POLLOCK, L. J.; GOLSETH, J. G.; and ARIEFF, A. J.: Use of discontinuity of strength duration curves in muscle in diagnosis of peripheral nerve lesions. Surg., Gynec. & Obst. 79: 133-141, Aug. 1944.



THE DETECTION OF CANCER CELLS

Smear Technique

KENNETH P. KNUDTSON

Lieutenant Commander (MC) U. S. N.

THE technique of diagnosis of cancer from single or groups of cells is not new. Dr. George Papanicolaou, Professor of Anatomy, Cornell University, initiated the study of the morphologic and cyclic variations of desquamated epithelial cells in the human vagina about 23 years ago (1). Later, in collaboration with Dr. Traut, the use of the vaginal smear for the diagnosis of uterine cancer was advocated (2). Other investigators, including Meigs and his coworkers (3), Ayre (4), and Jones et al. (5), have studied large series of cases by this method and have reported an accuracy in diagnoses to within 5 to 7 percent.

The simplicity of obtaining the smear-specimen is such that it can usually be done in the average physician's examining room. Since it is well established that malignant tissues possess the characteristic of desquamation to a greater degree than do normal tissues, the blood and secretion from the surface of a cancer lesion will contain cells which are morphologically malignant. Smears are now prepared not only from vaginal secretions, but also from endocervical and endometrial secretions, urine sediment, prostatic secretions, gastric and bronchial secretions removed by aspiration, pleural and peritoneal fluids, and sputum. Recently smears from the sigmoid colon and rectum have been proved diagnostic of malignancy. The technique of preparing and staining the smears differs only slightly with the various specimens. The vaginal fluid is aspirated with a glass pipette, spread evenly on a clean slide and fixed immediately in a solution of equal parts of 95 percent alcohol and ether. The endocervical and endometrial fluids are aspirated with a special flexible metal cannula.

For the urine, approximately 50 cc. of catheterized urine is considered sufficient. The urine is mixed with 95 percent alcohol or isopropyl alcohol and then centrifuged. Smears are prepared from the sediment and fixed in ether-alcohol. It is of great importance that the smears be immersed immediately in the ether-alcohol fixative to preserve the morphological detail of the cells. Gastric aspiration

and thoracic or peritoneal fluid specimens are prepared in the same manner. Sputum examinations are best made by fixing a specimen in 70 percent alcohol obtained after coughing and then preparing smears which are fixed in ether-alcohol. All smears are stained first in Harris' hematoxylin and then OG6 and EA36, EA50, or EA65 as described by Papanicolaou (2).

The smears prior to staining can be preserved for from 2 to 3 weeks, or even longer, in ether-alcohol. This affords an opportunity for mail shipment. (It has been suggested that the slides can be kept separate from one another in such a bottle by a paper clip on each slide.)

With proper use of the Papanicolaou stain the morphological characteristics of the cell are evident. It is essential to have an understanding of the normal cytology before evaluating a smear for the presence of cancer cells. The characteristics of the cancer cell are the same as those used in making the diagnosis from paraffin or frozen sections. The size, shape, density, location and structure of the nucleus, number and shape of the nucleoli, and the nuclear-cytoplasmic ratio are the most important criteria. Staining reaction of the cytoplasm, size of the cell, and the presence of groups of cells are important. The presence of red blood cells, histiocytes, and leukocytes is to be noted in the study of the stained smear. It is obvious that certain criteria are useful in all cases; however variations will occur depending on location, degree of anaplasticity of the cancer, inflammation and type of secretion.

The use of the smear technique has been found particularly useful in the diagnosis of early bronchogenic carcinoma from secretions aspirated from the bronchi. In England, positive diagnoses of bronchogenic carcinoma by smear technique are reported in as high as 68 percent of the cases; in Russia, in 70 percent; and in Denmark, in 86 percent (6). Herbut and Clerf (6) in 1946 reported cancer cells in 22 out of 30 consecutive cases of bronchogenic carcinoma; while in comparison, tissue removed endoscopically was reported as positive in but 11, or 36 percent, of these cases. Cancer cells were present in the secretions from 7 cases in which bronchoscopic examination was negative while sputa from 5 cases in which cancer cells were present in the bronchial secretions showed neoplastic cells in only 1 of the 5 specimens.

Wandall (8) of Copenhagen in 1944 reports an erroneous diagnosis in only 6 of 193 positive cases, a percentage error of 3.1 percent.

In June 1946, Papanicolaou reported 76 positive cases from urinary sediment out of a total of 240 cases examined. The percentage of errors in the negative group (classes 1 and 2) is 7.36 percent; in that of the positive group (classes 4 and 5); 3.45 percent. It is to be noted that the two false positives in classes 4 and 5 were both papillomas (7).

Dr. Papanicolaou's classification of reports on various types of smears as applied to the diagnosis of malignant neoplasms is as follows:

Class 1.—Absence of abnormal or atypical cells. (Negative.)

Class 2.—Atypical cells present but without abnormal features. (Negative.)

Class 3.—Cells with abnormal features but not sufficient to establish a positive diagnosis. (Suspicious.)

Class 4.—Fair number of pathognomonic cells and cell clusters. (Positive.)

Class 5.—Large number of conclusive cells and cell clusters. (Positive.)

The value of the vaginal smear is illustrated by the following case:

CASE REPORT

A white, married woman, 31 years of age, was seen at the Free Cancer Clinic at Garfield Hospital for routine examination. There were no symptoms and the physical examination was negative. Vaginal smears were prepared, fixed in ether-alcohol, and stained with EA36. The cells appeared abnormal, with large hyperchromic nuclei and prominent nucleoli, suggestive of malignant process; but no definite diagnosis could be established. However, biopsy after curettage showed adenoma malignum. (A total hysterectomy was performed and multiple blocks were taken from the entire uterus, but no additional tumor tissue was found.)

CONCLUSION

The simplicity of the vaginal smear test and its low cost have been an inducement to use it as a screening method for detecting early carcinoma. At the present time it has been proved by the experts in the field that it can be used successfully and with a relatively high degree of accuracy not only as a screening test but as a means of diagnosis. The value of the test is obvious and its importance as an adjunct to our present methods of diagnosis is shown by the willingness of the various public health services and cancer prevention clinics to accept this method as a routine procedure.

REFERENCES

1. PAPANICOLAOU, G. N.: New cancer diagnosis. Proc. Third Race Betterment Conference, 1928. p. 528.
2. PAPANICOLAOU, G. N., and TRAUT, H. F.: Diagnosis of Uterine Cancer by the Vaginal Smear. The Commonwealth Fund, New York, N. Y., 1943.
3. MEIGS, J. V.; GRAHAM, R. M.; FREEMONT-SMITH, M.; KIPNICK, I.; and RAWSON, R. W.: Value of vaginal smear in diagnosis of uterine cancer. Surg., Gynec. & Obst. 77: 449-461, Nov. 1943.
4. AYRE, J. E.: Simple office test for uterine cancer diagnosis. Canad. M. A. J. 51: 17-22, July 1944.
5. JONES, C. A.; NEUSTAEDTER, T.; and MACKENZIE, L. L.: Value of vaginal smears in diagnosis of early malignancy; preliminary report. Am. J. Obst. & Gynec. 49: 159-168, Feb. 1945.
6. HERBUT, P. A., and CLEEF, L. H.: Bronchogenic carcinoma; diagnosis by cytologic study of bronchoscopically removed secretions. J. A. M. A. 130: 1006-1012, Apr. 13, 1946.

7. PAPANICOLAOU, G. N.: Cytology of urine sediment in neoplasms of urinary tract. *J. Urol.* 57: 375-379, Feb. 1947.
8. WANDALL, H. H.: Study on neoplastic cells in sputum as contribution to diagnosis of primary lung cancer. *Acta chir. scandinav.* (supp. 93) 91: 1-14, 1944.

ACKNOWLEDGMENT.—The author is indebted to Dr. George N. Papanicolaou, professor of Anatomy, Cornell University, for reviewing this article.



PHYSIOLOGIC ASPECTS OF SURGICAL INFECTIONS

Lockwood emphasizes that the management of infection requires not only the administration of such type specific bacteriostatic agents which will aid the defense and recovery reaction of the tissues of the body, but also an early and direct approach to the correction of the altered physiologic processes and the restoration of the crystalloid and colloid balance of the tissue fluids. He concludes:

"1. Chemotherapeutic agents should be selected, and used, with a view toward aiding in the natural resistance of the body to infection.

"2. Although it is important, wherever possible, to employ treatment directed specifically against the bacteria involved in an infection, the treatment of associated disorders should not be neglected. In certain conditions the persistence of the infection is entirely dependent on an underlying physiological lesion, and in these cases, chemotherapy is of only secondary importance.

"3. Rational treatment of severe infections characterized by toxemia demands supportive measures as well as administration of chemotherapeutic agents. Particular attention must be given to maintenance of blood volume, provision of an adequate intake of protein, calories and vitamins, and surgical removal of the cause of the toxemia.

"4. Study of the pathologic physiology of the toxemia of infections should be encouraged, in the hope that mortality from these conditions may be still further reduced."—Lockwood, J. S.: Physiologic aspects of surgical infections. *Surg., Gynec. & Obst.* 84: 733-738, August 1947.

A TECHNIQUE FOR ALVEOLECTOMY

FREDERICK T. WIGAND

Commander (DC) U. S. N.

EACH dental surgeon has his own particular method of performing an alveolectomy. It is not the purpose of this article to present a new technique for performing this operation, but rather to present a technique which can be used effectively in a Navy dental office either afloat or ashore.

PREOPERATIVE PREPARATION

Preoperative preparation and treatment of the patient for surgery should be a prime consideration. To the dental surgeon, surgery is a relatively routine procedure and he is prone to lose sight of the fact that to each patient it is a new experience and one which he approaches with apprehension. Much can be done to overcome this by fully explaining to the patient the necessity for dental extraction. It should be further explained that in addition to the removal of the teeth, the parts surrounding the teeth will be made smooth. Such terms as chisel, grind, scrape, or cut should be avoided in explaining this phase of the operation. The patient should merely be told that the tissues which hold his teeth will be made uniform in order to provide a good foundation for his dentures.

Premedication consists of nembutal in doses of $1\frac{1}{2}$ to 3 grains. When the patient arrives at the office he is given a capsule of nembutal which has been pierced at the ends. The action of the drug given in this manner will usually manifest itself within 7 to 10 minutes.

Alveolectomies may be performed either under local or general anesthesia. However, inasmuch as general anesthesia is not always available and as local anesthesia is more generally used by dental surgeons in the Navy, it will be assumed that the latter is being employed with the technique to be described.

Nothing is more formidable to the patient than an array of surgical instruments and it is important that he does not see any of them when he enters the dentist's office. Crossbar elevators, scalpels, and forceps tend to alarm him. The elimination of undesirable influences is necessary to allay the patient's nervousness and apprehension.

The only instrument which the patient sees is the syringe containing procaine, lying on the bracket table. It is intended that he see this. Naturally, patients are concerned as to whether they are going to feel any pain. When they see the syringe on the table they know that they are to be given an injection, and although they may not relish the thought of the needle, it lends a sense of security.

The author finds it advantageous to spray the inside of the mouth with a 2-percent pontocaine hydrochloride solution before making the necessary injections. This produces a good topical anesthesia, making it possible to effect painless needle insertions. It will also preclude any tendency on the part of the patient to gag when instruments and gauze sponges are introduced into the mouth.

Following the anesthetizing, the patient's head is draped with a towel in such a way as to cover the eyes and confine the hair (fig. 1). There are two definite advantages in doing this: (a) When the patient is unable to watch the dental surgeon's movements he remains much more calm and relaxed; otherwise, he involuntarily tenses and draws his head away upon observing a strange instrument being brought near his mouth. (b) This prevents blood or debris from getting into the eyes. Confining the hair is desirable, in that when it is necessary for the operator to change the position of the patient's head he can do so by placing his hand on a clean head towel rather than directly in the patient's hair. It also keeps the hair out of the area of operation, which is a desirable factor, especially when operating on female patients.

After the head is draped, the face is sponged with alcohol in order to obtain a surgically clean field. The lips are then covered with a light coat of vaseline to keep them moist and pliable.

OPERATIVE PROCEDURE

Following the above-described preparations, the inside of the mouth is swabbed with a gauze sponge to remove saliva, and as a further attempt to attain a dry field the immediate area to be operated upon is walled off with sponges. These are placed in the posterior portion of the mouth and over the tongue in such a manner as to prevent sanguineous drainage into the throat.

The operation begins by making a flap exposing the buccal and labial bone over the teeth. This is accomplished by making a straight incision about one-half inch distal to the last remaining tooth in the arch and then with a periosteal elevator freeing the mucous membrane from the bone. It is wise to dissect vertically the minimum amount of tissue necessary to expose the labial and buccal plate. Excessive detachment of this flap tends to cause more swelling in the circumoral



Figure 1.—Head draped for dental surgery.

region. The retraction of this tissue is best accomplished by placing a sponge under the flap and holding it with the fingers (fig. 2). This method promotes a clearer view of the immediate site of operation in that it controls hemorrhage from the soft tissue and gives more extensive retraction. Another advantage of this procedure is that it prevents bone spicules from lodging under the soft tissue at the mucoperiosteal juncture.

Bone is removed over the labial and buccal surfaces of teeth to be extracted by placing the chisel at the alveolar crest of the maxillary bone parallel to the long axis of the tooth and tapping until a portion of bone is planed from the tooth nearly to the apex (fig. 2). The bone



*Figure 2.—Method of retracting soft tissue with sponge.
Removal of labial bone.*

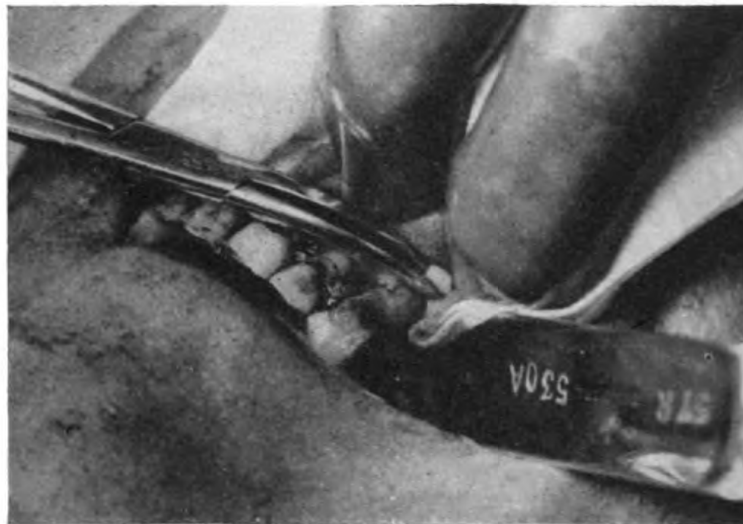


Figure 3.—Detachment of alveolar bone with curved hemostat.

is not removed at this time. Final detachment and removal is achieved by the use of the curved hemostat (fig. 3). This method prevents bone particles from being projected into the air, and so we seldom have any lost spicules appear as "sore spots" under a denture.

Extraction of the teeth is the next phase of the operation. The fact that the external portion of the alveoli has been eliminated expedites the removal of the teeth. In extracting the cuspids, which occasionally prove highly resistant to removal, it has been found advantageous to first remove the lateral incisor and the first bicuspid



Figure 4.—Extraction of teeth. First bicuspid and lateral incisor first extracted to facilitate removal of cuspid.

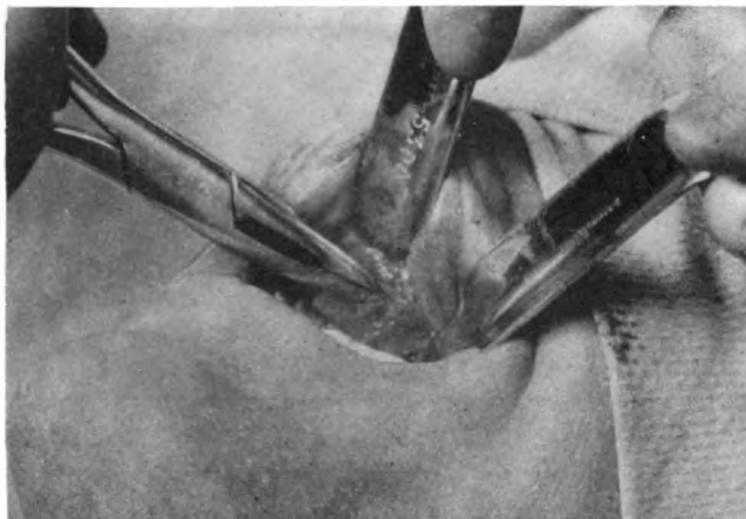


Figure 5.—Trimming alveolar process with rongeur.

(fig. 4). When this is done, not only is it possible to obtain a mesial distal application of the forceps on the crown of the tooth to facilitate rotation but the lack of adjacent teeth also allows more “give” in the alveolus.

Trimming of the alveolar process is best effected with the rongeur and bone file. The tip of the rongeur is inserted in the alveolus (fig. 5) and rough surrounding edges are made smooth. Sharp points and bony protuberances are also eliminated with this instrument. Conservative reduction of the alveolar process should be the rule



Figure 6.—Removal of excess soft tissue. Note smooth alveolar bone.

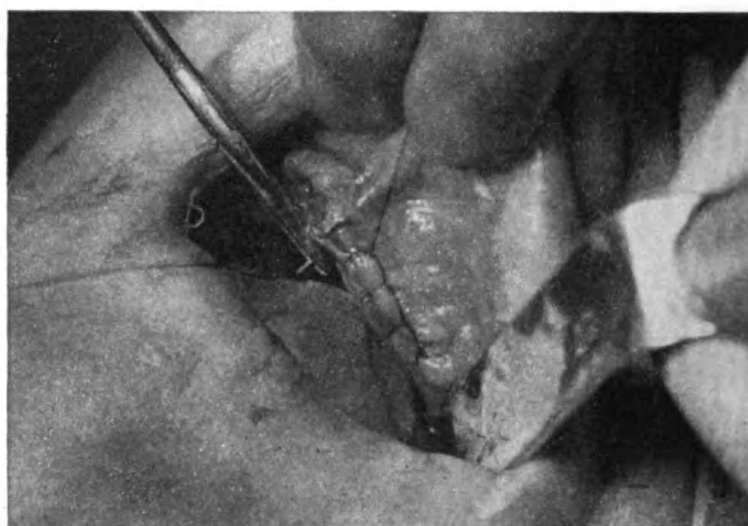


Figure 7.—Closure of wound with continuous blanket suture.

Only enough bone should be removed to avoid undercuts and sharp areas. In looking for the latter, it is not well to be guided solely by visual examination. Palpation should also be utilized to seek undesirable spots. It is well when doing this to replace the flap over the bone and then to feel for sharp points. Frequently, areas which feel smooth when the finger is held directly against the alveolar process will be found to be unsatisfactory when palpated with the gum tissue in place.

Careful débridement of the site following the removal of alveolar process is important. With curets and the curved hemostat all loose

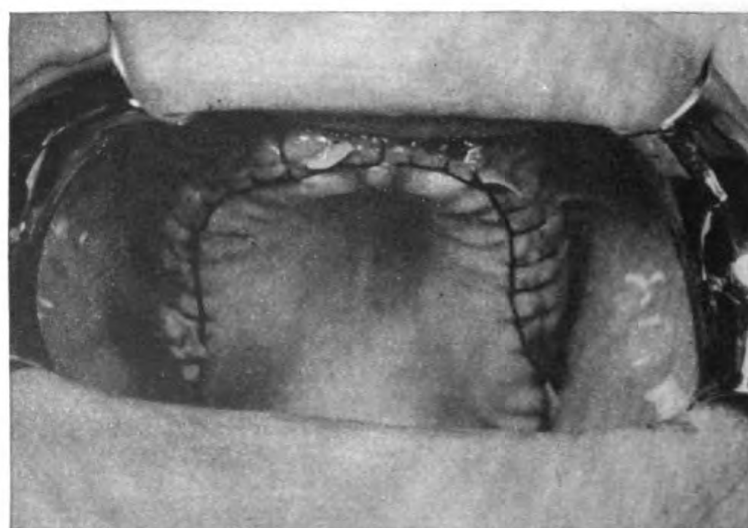


Figure 8.—Completed operation. Rubber dam drains in cuspid and molar regions.

bone spicules and filings are removed. Thorough attention to this detail will be rewarded with a more rapid healing and less likelihood of postoperative infection.

Removal of excess soft tissue constitutes the next step in the operation. This may be done with scissors (fig. 6) or a scalpel. The tissue flaps should be approximated and the amount of excess to be excised should be determined. This will vary in accordance with the amount of bone which has been trimmed. Insofar as possible, without causing displacement of the mucobuccal and mucolabial fold, an attempt should be made to approximate completely the incised edges of the wound. Thus healing by first intention will be secured, the amount of granulation tissue necessary will be minimized, and more rapid healing and regeneration of tissue will result. Although as much gingival tissue should be conserved as possible, care should be taken not to leave a mass of redundant tissue on the alveolar ridge.

Before suturing, the area of operation is lightly sprayed with sulfathiazole powder. It has been found that a light application of the drug produces the most beneficial results. When there is an excess of the medication in the wound it tends to form clumps which act as a foreign body and inhibits healing.

The wound is closed with a continuous blanket suture (fig. 7). Plain autoclaved, black cotton thread (No. 50) is used. This is easy to handle, is inexpensive, is comfortable in the mouth, and does not cause tissue reaction.

Inasmuch as serosanguineous drainage may be anticipated from this type of wound, the author has found it beneficial to insert rubber dam drains one-half inch in length and slightly less than a quarter of an inch wide, vertically into the incision. Four of these drains placed in the molar and cuspid regions will usually be sufficient (fig. 8).

The operation is completed by spraying the sutured incision with sulfathiazole and then covering with moist gauze packs upon which the patient bites for from 10 to 15 minutes. This procedure arrests hemorrhage and keeps saliva out of the wound until a clot is formed. Drains may be removed the second day and the sutures removed after 4 or 5 days.



PRIMARY MUMPS MENINGO-ENCEPHALITIS

Review of Literature and Report of a Case

KENNETH P. BACHMAN

Lieutenant (MC) U. S. N.

IN ORDER to give an over-all picture of mumps meningo-encephalitis a brief historical review is presented. This review is by no means a comprehensive one; completeness would require a book. However, a bird's-eye view of this interesting disease may be procured from such an outline even though it be but moderately detailed.

REVIEW OF THE LITERATURE

- 1790 Hamilton (1) made the first recorded observation of mumps meningitis, then called "a distemper."
- 1902 Monod (2) reported the first spinal fluid examinations in cases of mumps. Six of eight cases of fully developed mumps showed an increase in the number of spinal fluid cells.
- 1904 Chauffard and Boidin (3) described a lymphocytosis in the spinal fluid of cases of mumps and they considered it a complication of the disease.
- 1904 Dopfer (4) suggested that the mumps virus should be considered as being localized primarily in the meninges rather than its presence there being regarded as a complication of mumps.
- 1910 Halle and Tixier (5) described cases of mumps meningitis which preceded the parotitis.
- 1911 Teisser and Schaeffer (6) described an increase in the number of spinal fluid cells in all of 20 cases of mumps.
- 1913 Gordon (7) produced encephalitis in monkeys by injecting mumps saliva filtrates intraspinally.
- 1917 de Massary, Tockmann, and Luce (8) reported 16 cases of clinical meningo-encephalitis in a group of 635 cases of mumps. They further reported an increase in numbers of spinal fluid cells in all of 40 cases of mumps so studied.
- 1918 Brooks (9) reported a series of 1,059 cases of mumps at Camp Upton, none of which were clinically complicated by meningo-encephalitis.
- 1918 Radin (10) reported a series of 5,756 cases of mumps at Camp Wheeler, none of which were clinically complicated by meningo-encephalitis. However, he did report three cases of meningismus with symptoms such as nuchal rigidity, positive Babinski, and accentuated knee jerks. The spinal fluid was reported as negative in all three cases.

- 1918 Wollstein (11) using pooled filtered mouth washings from mumps patients injected the filtrate into cats subcutaneously, into the parotids, and intrathecally. Using spinal fluid from cats injected intrathecally she was able to produce the disease in and to pass the disease to other cats.
- 1919 Macleod (12) reported a series of 694 cases of mumps, none of which were clinically complicated by meningitis. In 40 cases, however, the temperature rose suddenly on the seventh to the tenth day without clinical evidence of complications. (To be discussed later.)
- 1919 Casparis (13) described neurologic symptoms preceding cases of mumps parotitis.
- 1920 Larkin (14) reported 2,400 cases of mumps at Camp Taylor Base Hospital; only 2 patients in this series showed meningeal symptoms.
- 1925 Walker (15) described neurologic symptomatology preceding cases of mumps parotitis.
- 1926 Bezancon and Philibert (16) stated that mumps should be regarded as a primary encephalitis with secondary localization in the parotids, testes and other organs.
- 1926 Wallgren (17) recorded the cases of three brothers who were simultaneously exposed to mumps. One developed parotitis; one developed parotitis and meningitis; and one developed only a benign meningitis.
- 1930 Weissenbach; Basch, G., and Basch, M. (18) concluded that in mumps the central nervous system is primarily involved and other organs only secondarily.
- 1932 Philibert (19) restated his belief that mumps is primarily a disease of the central nervous system for (a) the virus can be demonstrated in the spinal fluid; (b) frequently the virus causes an inflammatory process which reflects itself by a pleocytosis in the spinal fluid and often in clinical meningitis; and (c) a number of cases were reported in which meningitis preceded the parotitis.
- 1932 Paddock (20) stated that clinical meningitis was a rare complication of mumps; its incidence varied from 0.15 to 0.5 percent in different epidemics.
- 1933 McKaig and Woltman (21) reported that cultures taken from Stensen's duct in cases of mumps myelitis when injected into rabbits produced paralysis in 8 hours in one animal.
- 1934 Montgomery (22) noted and stated that the frequency of mumps meningitis varied with the epidemic.
- 1934 Johnson and Goodpasture (23) (24) showed that an agent present in the saliva of patients with mumps was capable of causing experimental mumps when injected into the Stensen's duct of monkeys. The agent proved to be filterable, resistant to freezing and drying, preservable in glycerin, transferable through monkeys, and when sprayed into immunes and susceptibles, it caused disease in susceptible human beings.
- 1934 Findlay and Clarke (25) confirmed the isolation of the mumps virus in monkeys and also showed that it could produce an orchitis in monkeys.
- 1938 de Lavergne, Kissel, and Accoyer (26) were among the first to prove the diagnosis of mumps meningo-encephalitis. They isolated the virus from the spinal fluid by means of intrathecal inoculation of the spinal fluid into rabbits. Rabbits so inoculated did show a pleocytosis.
- 1938 Finkelstein (27) reported an increase in numbers of cells in the spinal fluid in 16 of 40 cases of mumps.

- 1938 Harris and Bethel (28) reported one case of mumps meningitis and orchitis without parotitis. They emphasized that parotitis is only a common complication and not an essential feature of the disease.
- 1939 Birnberg (29) reported 38 cases of mumps meningo-encephalitis in children.
- 1940 Tabor and Newman (30) presented the opinion that minor mental changes may occur following mumps meningo-encephalitis.
- 1941 Frankland (31) reported 30 percent meningeal involvement in a series of 234 cases of mumps. Meningitis was observed without parotitis or orchitis.
- 1941 Snapper (32) referring to the work of McKaig and Woltman (46) stated that "recent research seems to indicate that the virus is always present in the spinal fluid of patients with mumps." A case of mumps with polyradiculitis, myelitis, and herpes zoster was presented. Snapper noted that only four previous cases (he presented one) of herpes zoster complicating mumps had been reported—all by French clinicians.
- 1942 Wesselhoeft (33) offered the opinion that mumps is to be considered basically as a systemic disease with a special predilection for the salivary glands, mature gonads, pancreas, and breasts.
- 1943 Enders (34) described a complement fixation test using infected parotid gland of the monkey as a source of antigen. Positive tests correlated well with a history of mumps but about 50 percent of individuals without a history of mumps showed serum antibodies suggesting that in these persons the disease had been unrecognized.
- 1944 McGuinness and Gall (35) reported a series of 1,378 cases of mumps in which series 55 cases of known or suspected involvement of the central nervous system were present. Spinal punctures were done in 19; of these, 16 cases showed pleocytosis.
- 1944 Steinberg (36) reported 10 cases (6 percent) of clinical meningo-encephalitis in a series of 165 cases of mumps.
- 1944 Candel, Wheelock, Turk, and Smoot (37) reported 38 cases of mumps, 30 of which (79 percent) showed an increase in the number of spinal fluid cells; 53 percent had subclinical meningitis; 26 percent had clinical meningitis.
- 1944 Cardelle Penichet, Ducassi, Mata Lavin, and Rodriguez (38) reported a case of primary mumps meningo-encephalitis.
- 1945 Halcrow and Wang (39) reported a case of mumps with meningo-encephalitis and orchitis.
- 1945 Coe (40) reported a case of primary mumps orchitis with meningitis. He stated that meningitis usually appears within a week of the onset of parotid swelling but may precede the parotitis or be the sole manifestation of the disease.
- 1945 Enders, Kane, Cohen, and Levens (41) (42) (43) further showed that the complement fixation test is of value in the diagnosis of mumps meningo-encephalitis, especially in the absence of glandular involvement. They proved that the antibody was indeed specific.

It was further shown that the antibody appears in the serum in from 8 to 14 days after the initial infection and that both this antibody, as shown by the complement fixation test, and a hypersensitive state as shown by skin tests may persist for at least $1\frac{1}{2}$ to 2 years following recovery.

Specific dermal hypersensitivity in humans was demonstrable by injecting heat inactivated mumps virus. However, this skin test is of value mainly as an index to resistance and not for diagnosis since it does not become positive until after recovery. Incidentally, they showed that concentrated globulins may be of some therapeutic value.

- 1945 Habel (44) grew the mumps virus in the chick embryo and showed that an effective antigen for serologic tests can be produced from such a source.
- 1946 Holden, Eagles, and Stevens (45) reported a series of 100 cases of mumps hospitalized at Fort Benning. Their data showed 33 cases with clinical signs of meningo-encephalitis, 28 of which showed abnormal spinal fluid. Ten cases presented evidence of subclinical involvement of the central nervous system; 8 showed increased spinal fluid protein to 30 or more milligrams per 100 cc.; 4 showed pleocytosis of 10 or more per cubic centimeter, and 2 showed both abnormal protein and pleocytosis. They stated that there was no correlation between the occurrence of central nervous system involvement, the severity or the number of salivary glands involved, and the presence of epididymo-orchitis.

GENERAL DISCUSSION

Causation: The specific filterable virus of mumps.

Source of infection: Secretions of the mouth and/or nose of infected individuals and articles soiled by such secretions.

Mode of transmission: de Lavergne (26) believes that the meningeal infection precedes the parotitis and that the virus enters through the olfactory route. Dopfer (47) regards the mumps virus as one which is neurotropic and which may enter as in poliomyelitis.

Incubation period: From 12 to 26 days, most commonly 18 to 21 days (48).

Prevalence: The disease is most common in the winter and spring.

The number of cases of mumps meningo-encephalitis or meningitis reported in any one series has varied from less than 0.1 percent to as high as 100 percent. Such variation would appear to depend on the following factors:

(a) *The definition of meningitis.*—Numerous authors (8) (9) (10) (12) (14) (35) (36) have reported only on the presence or absence of cases of clinical meningitis and/or meningo-encephalitis. Other authors, such as Teisser (6), Candel, et al. (37), and Holden, et al. (45), reported all cases in which an increase in the number of spinal fluid cells was observed, with or without clinical symptoms. Candel, et al. (37) state that "a pleocytosis of the spinal fluid should be considered as evidence of the presence of a meningitis, with or without the presence of clinical manifestations." Certainly it is rare for physicians to perform spinal taps routinely on all cases of mumps. Yet, if you agree, as does the writer, with Candel's definition of meningeal involvement, then the

only way to secure accurate statistics as to the number of cases of mumps which show meningeal disease would be to perform such routine spinal taps. (This does not mean that the writer is suggesting that this be done.) This factor alone accounts for a great part of the discrepancy in reported frequency of this disease.

(b) *The physician himself.*—Awareness of and a search for signs and symptoms of this disease by the physician is a vital factor in amassing statistical evidence. The writer is certain that he, for one, in times past overlooked subclinical or low-grade clinical cases of mumps meningo-encephalitis.

(c) *The epidemic, per se.*—Figures reported for clinical cases vary with different epidemics (22). It may well be and is almost undoubtedly true that the virulence, invasiveness, or strain of the virus agent may vary from time to time.

(d) *Immunity of the host.*—The work of Enders, et al. (34) suggests that certain individuals who have never had mumps are nevertheless immune to this disease. Moreover, second attacks of mumps, so-called recurrences and relapses, do occur. Thus the degree of immunity of the host may play a small part in varying reported statistics.

Certainly mumps is not as common as measles or chickenpox. It may be that the mumps virus, like the virus of poliomyelitis, is much more widespread than is commonly believed and that subclinical cases are considerably more frequent than we previously thought.

Pathology.—According to Biggard (49), Larkin (14), and Gordon (7), the main findings appear to consist of (a) pleocytosis and (b) meningeal inflammation with congestion of the pia, edema, and patchy infiltration of mononuclear cells (lymphocytes) into the perivascular tissue along the cerebral blood vessels.

Biggard (49) states: "The pathological picture resembles that of aseptic lymphocytic meningitis."

Symptoms.—Symptoms are mainly those of any acute infection plus those which are associated with meningeal irritation with or without increased intracranial pressure:

- (a) General malaise, weakness.
- (b) Fever.
- (c) Chills—these may be frank, shaking chills.
- (d) Rhinitis, pharyngitis.
- (e) Conjunctival injection.
- (f) Headache—apt to be frontal and may be throbbing in character.
- (g) Bradycardia, bradypnea.
- (h) Anorexia, nausea, vomiting.
- (i) Herpes zoster (rare) (32).

- (j) Neuritis.
- (k) Drowsiness, irritability, rarely delirium.
- (l) Rarely convulsions or other evidence of focal lesions (such as ptosis of one eyelid).

Any or all of the above-listed symptoms may appear either initially, during, or subsequent to involvement of the glandular structures commonly affected. The only symptom and sign of such meningeal involvement may be an elevation in temperature. Candel et al. (37) has already pointed out the fact that in Macleod's (12) series of 694 cases, in which the temperature of 48 patients rose suddenly on the seventh to the tenth day, this rise in temperature may have been due to a so-called atypical or subclinical case of mumps meningitis or meningo-encephalitis.

However, admittedly we should also bear in mind that pancreatitis in a subclinical form may be the etiologic basis for such a rise in temperature, as also may be, for example, oophoritis in the female. Nevertheless, by far a more common cause of such a symptom in this disease is undoubtedly the onset of central nervous system involvement. Spinal taps at such a time, the writer feels, would substantiate this point.

Physical findings.—These consist largely of signs of meningeal irritation with or without signs of increased intracranial pressure. Physical findings which may be seen are:

- (a) Nuchal rigidity.
- (b) Positive Kernig.
- (c) Hyperactive reflexes.
- (d) Pathological reflexes (relatively rare).
- (e) Tache cérébrale (36).
- (f) Blurring of optic disks (rare).
- (g) Signs of focal lesions (relatively rare).

Spinal fluid.—Findings are as follows:

- (a) Pressure—normal to moderately increased.
- (b) Cell count—normal to moderately increased; usually below 200. (Steinberg (36) reported one count of 602 and Snapper (32) reported one of 690, but these are unusually high.) Lymphocytes predominate.
- (c) Protein—normal to moderately increased; rarely above 75 mg. per 100 cc.
- (d) Sugar—normal.
- (e) Chlorides—normal.
- (f) Smears and cultures—negative for bacteria. The mumps virus can be cultured in the developing chick embryo (44).

Diagnosis.—The complement fixation test as developed by Enders and his coworkers (34) (41) (42) (43) is apparently of great value for the serologic diagnosis of this disease. The skin test as developed by Enders and coworkers (42) is of limited value.

Mumps meningo-encephalitis or meningitis may be confused with and must be differentiated from aseptic lymphocytic meningitis (lymphocytic choriomeningitis), nonparalytic poliomyelitis, and other types of virus encephalitis and meningitis.

Treatment.—Treatment consists of:

(a) Symptomatic therapy; lumbar puncture will frequently relieve severe headache.

(b) The use of convalescent mumps serum. Convalescent human serum may be used for prophylaxis after known exposure and during the incubation period.

(c) Use of concentrated or gamma globulin.

(d) Pooled plasma may be of slight value.

Complications and sequelae.—With reference to mumps, Biggart (49) states: "The human disease is rarely complicated by hemiplegia, aphasia, and optic neuritis."

According to standard texts (49) (50) (51) the most common complications are inflammation and atrophy, therefore neuritis, of the cranial and/or peripheral nerves. The cranial nerves are most commonly involved, especially the second and the eighth nerves.

Tabor and Newman (30) feel that minor mental changes may be noted following some cases of mumps meningo-encephalitis.

Prognosis.—Generally speaking the aforementioned complications and sequelae are relatively rare. Complete recovery usually ensues. The prognosis, therefore, is usually excellent.

CASE REPORT

27 April 1948.—The patient, a 23-year-old male, reported to the admission room at the United States Naval Hospital, St. Albans, N. Y. His chief complaints consisted of chills and fever.

Further inquiry revealed that approximately 17 hours before admission, the morning of 26 April, he had awakened with a moderate throbbing frontal headache. This headache, however, improved during the day, and in the evening, previous to admission, he had attended a dance. While at the dance, around 2200, he became chilly and developed a fever. He decided to report to the admission room.

Upon initial examination a temperature of 103° F. was recorded; blood pressure was 125/85. Physical examination was said to be entirely negative.

At approximately 0730 on 27 April 1947 the patient's pulse was 120, temperature 103.4° F., respiration 20, blood pressure 110/68 (supine); and he presented the following positive findings: (1) a few questionable petechia in both conjunctivae; (2) slight blurring of the medial side of both optic disks—possibly

within normal limits; (3) definite ptosis of left upper eyelid; (4) mild nuchal rigidity; (5) mild rhinitis; (6) positive Kernig; and (7) atelectatic râles heard at both lung bases.

A diagnostic spinal tap was performed at once. The initial pressure was 198 millimeters; the fluid appeared clear. The Queckenstedt test was essentially normal. (It is realized that some members of the profession would have preferred that a Queckenstedt test not be done.)

Laboratory studies on the spinal fluid revealed:

Negative smear. White blood cell count, 301 cells, 78 percent segmented leukocytes and 28 percent lymphocytes. Red blood cells, 22. Total protein, 51.5 mg. per 100 cc. (normal range is 25 to 50 mg. per 100 cc.). Sugar, 45.5 mg. per 100 cc. Chlorides, 740 mg. per 100 cc. Culture, reported negative on 29 April 1947.

The white blood cell count was 14,950; 75 percent segmented leukocytes, 21 percent lymphocytes, 1 percent eosinophils, and 3 percent monocytes.

Urinalysis: albuminuria, 20 mg. per 100 cc.

Roentgenogram: Lung fields were clear; heart and aorta appeared normal.

In view of the above findings, even though the smear of the spinal fluid was negative, the patient was treated with penicillin, 50,000 units every 3 hours, plus sulfadiazine 0.5 gram and sulfathiazole 0.5 gram every 4 hours, together with an equivalent amount of sodium bicarbonate. Other routine symptomatic therapy was instituted; 1,000 cc. of 5 percent dextrose in physiologic saline solution was given.

28 April 1947.—Patient became asymptomatic and temperature dropped to 100.3° F.

Physical examination now revealed slight enlargement of the left parotid gland associated with mild injection of the nasal and pharyngeal mucous membranes. There was no inflammation of Stensen's duct, no lymphadenopathy, and there was not any difficulty in swallowing. Signs of meningo-encephalitis had now disappeared.

Temperature rose to 101.4° F. in the evening.

29 April 1947.—The right parotid gland became enlarged and tender. Temperature rose to 101.6° F. Sulfa drug therapy was discontinued.

1 May 1947.—Both parotids were moderately enlarged and tender; slight difficulty in swallowing. Patient felt essentially well.

4 May 1947.—Temperature had dropped by lysis and was 98.6° F. this date.

6 May 1947.—Temperature rose to 101.4° F. The right testicle became moderately swollen and tender.

8 May 1947.—Temperature reached peak of 102.6° F.; maximal symptoms of orchitis noted. There was moderate swelling and tenderness of the right testicle. Red blood cell count, 4.1 million; hemoglobin, 13 grams. White blood cell count, 9,150; 54 percent segmented leukocytes, 30 percent lymphocytes, 4 percent basophiles, 3 percent eosinophils, and 6 percent monocytes.

10 May 1947.—Temperature now 98.6° F.; right testicle now slightly swollen and tender.

11 May 1947.—Patient remained afebrile.

14 May 1947.—Discharged to duty.

SUMMARY

1. A brief historical review of the disease mumps meningo-encephalitis has been presented.

2. A general review of the disease has been outlined. A point worthy of note is the fact that mumps may be considered as a systemic disease in which the virus frequently, if not always, acts as a neurotropic virus.

3. Etiologic bases for the discrepancies in reported statistics of the frequency of this disease have been noted.

4. A case of primary mumps meningo-encephalitis, subsequently followed by bilateral parotitis and right-sided orchitis, has been presented. The initial spinal fluid cell count in this case showed a preponderance of leukocytes of the segmented type. It is suggested that in this disease, as in other virus diseases of the central nervous system, there may be an increase in the total cell count in the earliest stages. The initial increase is largely made up of cells of the segmented type. These cells are then replaced by lymphocytes.

5. The case presented is also somewhat distinctive in that at least one sign of focal involvement was present, namely, a definite and marked, although quite temporary, ptosis of the left upper eyelid.

REFERENCES

1. HAMILTON, R.: Account of distemper by the common people in England vulgarly called the mumps. *Trans. Roy. Soc. Edinburgh*, 2: 59-72, 1790.
2. MONOD, R.: Reaction meningees chez l'enfant. Thesis, Paris, No. 77, 1902.
3. CHAUFFARD and BODIN: Originally cited by Philibert, A.; quoted by Candel, et al.
4. DOPTER, C. H. A.: *Precls de maladies infectieuses*. Soc. Méd. des Hôpitaux March 23 and July 29, 1904, and Feb. 27, 1905.
5. HALLE, J., and TIXIER, L.: Un cas de meningite cerebro spinale pre-ourlienne. *Comptes rendus de L'association Francaise de Pediatie*, 1910. pp. 290-293.
6. TEISSER, P., and SCHAEFFER, H.: Bradycardie dans les oreillons. *Cong. franc. de med., Onzieme session, Paris 1910; Comptes rendus* 2: 30-35, 1911.
7. GORDON, M. H.: On a fatal illness in children associated with acute interstitial parotitis. *Lancet* 2: 275-279, Aug. 1913.
8. de MASSARY, E.; TOCKMANN, and LUCE: La meningite ourlienne; sa constance, son evolution, sa dursee. *Bull. Acad. de med. Paris* 78: 6-8, July 3, 1917.
9. BROOKS, H.: Neurocirculatory asthenia, epidemic parotitis as military disease. *Med. Clinics N. America* 2: 477, Sept. 1918.
10. RADIN, M. J.: Epidemic of mumps at Camp Wheeler, October 1917-Mar. 1918. *Arch. Int. Med.* 22: 354-360, Sept. 1918.
11. WOLLSTEIN, M.: A further study of experimental parotitis. *J. Exper. Med.* 28: 377-385, Oct. 1918.
12. MACLEOD, G.: Mumps in adults; analysis of 694 cases. *Brit. M. J.* 2: 742-743, Dec. 6, 1919.
13. CASPARIS, H. R.: Cerebral complications in mumps. *Am. J. Dis. Child.* 18: 187-193, Sept. 1919.
14. LARKIN, W. R.: Mumps meningitis found at Camp Taylor Base Hospital. with autopsy findings. *Illinois M. J.* 38: 133-135, Aug. 1920.
15. WALKER, F. D.: Case of mumps with cerebral complications. *U. S. Nav. M. Bull.* 23: 42-43, July 1925.

16. BEZANCON, F., et al.: *Maladies infectieuses*, vol. 2. Masson & Cie, Paris, France, 1926. p. 294.
17. WALLGREN, A.: Méningite ourlienne sans oreillons. *Acta Paediat.* 6: 53-66, Aug. 1926.
18. WEISSENBACH, R. J.; BASCH, G., and BASCH, M.: La méningite et la méningo-encéphalite ourliennes primitives. *Ann. de med.* 27: 5-38, Jan. 1930.
19. PHILIBERT, A.: Nouvelle conception de la pathogénie des oreillons. *Progrès méd.* pp. 145-153, Jan. 23, 1932.
20. PADDOCK, B. W.: Mumps associated with meningitis in identical twins. *Am. J. Dis. Child.* 44: 565-568, Sept. 1932.
21. MCKAIG, C. B., and WOLTMAN, H. W.: Neurologic complications of epidemic parotitis; report of case of parotitis myelitis. *Proc. Staff Meet., Mayo Clin.* 8: 542-544, Sept. 6, 1933.
22. MONTGOMERY, J. C.: Mumps meningo-encephalitis. *Am. J. Dis. Child.* 48: 1279-1283, Dec. 1934.
23. JOHNSON, C. D., and GOODPASTURE, E. W.: Investigation of etiology of mumps. *J. Exper. Med.* 59: 1-19, Jan. 1934.
24. JOHNSON, C. D., and GOODPASTURE, E. W.: Etiology of mumps. *Am. J. Hyg.* 21: 46-57, Jan. 1935.
25. FINDLAY, G. M., and CLARKE, L. P.: Experimental production of mumps in monkeys. *Brit. J. Exper. Path.* 15: 309-313, Oct. 1934.
26. de LAVERGNE, V.; KISSEL, P., and ACCOYER, H.: Etude sur la période d'incubation des "oreillons." *Bull. Acad. de méd. Paris* 119: 534-540, May 17, 1938; also *Paris méd.* 1: 477-483, June 4, 1938.
27. FINKELSTEIN, H. (West Orange, N. J.): Meningo-encephalitis in mumps. *J. A. M. A.* 111: 17-19, July 2, 1938.
28. HARRIS, W. (London), and BETHELL, H.: Meningo-encephalitis and orchitis as only symptoms of mumps. *Lancet* 2: 422, Aug. 20, 1938.
29. BIRNBERG, T. L.: Mumps meningo-encephalitis. *Minnesota Med.* 22: 173-177, Mar. 1939.
30. TABOR, S. H., and NEWMAN, B.: Mumps meningo-encephalitis; analysis of 29 cases. *Arch. Pediat.* 57: 133-138, Mar. 1940.
31. FRANKLAND, A. W.: Mumps meningo-encephalitis. *Brit. M. J.* 2: 48-49, July 12, 1941.
32. SNAPPER, I.: *Chinese Lessons to Western Medicine; A Contribution to Geographical Medicine from the Clinics of Peiping Union Medical College.* Interscience Publishers, Inc., N. Y., 1941. pp. 51-56.
33. WESSELHOEFT, C.: Medical progress; mumps. *New England J. Med.* 226: 530-534, Mar. 26, 1942.
34. ENDERS, J. F.: Observations on immunity in mumps. *Ann. Int. Med.* 18: 1015-1019, June 1943.
35. MCGUINNES, A. C., and GALL, E. A.: Mumps at Army camps in 1943. *War Med.* 5: 95-104, Feb. 1944.
36. STEINBERG, C. L.: Mumps meningo-encephalitis. *U. S. Nav. M. Bull.* 42: 567-570, Mar. 1944.
37. CANDEL, S.; WHELOCK, M. C.; TURK, J. P., JR., and SMOOT, J. L.: Mumps meningitis. *U. S. Nav. M. Bull.* 42: 861-870, Apr. 1944.
38. CARDELLE PENICHER, G.; DUCASSI, F.; MATA LAVIN A., and RODRIGUEZ, D.: Un caso de meningo-encefalitis, parotidea primitiva. *Rev. méd.—social san. y benef. munic.* 4: 87-90, Oct.-Dec. 1944.
39. HALCROW, J. P. A., and WANG I.: Mumps meningo-encephalitis and orchitis. *Brit. M. J.* 1: 770-771, June 2, 1945.

40. COE, R. P. K.: Primary mumps orchitis with meningitis. *Lancet* 1: 49-50, Jan. 13, 1945.
41. ENDERS, J. F.; KANE, L. W.; COHEN, S.; and LEVENS, J. H.: Immunity in mumps; experiments with monkeys (*Macacus mulatta*). Development of complement-fixing antibody following infection and experiments on immunization by means of inactivated virus and convalescent human serum. *J. Exper. Med.* 81: 93-117, Jan. 1945.
42. ENDERS, J. F.; COHEN, S.; and KANE, L. W.: Immunity in mumps; Development of complement-fixing antibody and dermal hypersensitivity in human beings following mumps. *J. Exper. Med.* 81: 119-135, Jan. 1945.
43. KANE, L. W., and ENDERS, J. F.: Immunity in mumps; Complement fixation test as aid in diagnosis of mumps meningoencephalitis. *J. Exper. Med.* 81: 137-150, Jan. 1945.
44. HABEL, K.: Cultivation of mumps virus in developing chick embryo and its application to studies of immunity to mumps in man. *Pub. Health Rep.* 60: 201-212, Feb. 23, 1945.
45. HOLDEN, E. M.; EAGLES, A. Y.; and STEVENS, J. E., JR.: Mumps involvement of central nervous system. *J. A. M. A.* 131: 382-385, June 1, 1946.
46. MCKAIG, C. B., and WOLTMAN, H. W.: Neurologic complications of epidemic parotitis; report of case of parotitis myelitis. *Arch. Neurol. & Psychiat.* 31: 794-808, Apr. 1934.
47. DOPFER, C. H. A.: Communication published under annotations: Meningeal infection in mumps. *Lancet* 2: 32, July 1938.
48. American Public Health Association: Control of communicable diseases; report of committee of American Public Health Association. *Pub. Health Rep.*, 50: 1017-1077, Aug. 9, 1935.
49. BIGGART, J. H.: Pathology of the Nervous System. E. & S. Livingstone, Edinburgh, 1940, p. 159.
50. MUSSEY, J. H.: Internal Medicine, Its Theory and Practice. Lea and Febiger. Philadelphia, Pa., 1940. p. 357.
51. JORDAN, E. O., and BURROWS, W.: Textbook of Bacteriology. W. B. Saunders Co., Philadelphia, Pa., 1947. p. 818.



THE USE OF HYALURONIDASE

ARVIN T. HENDERSON

Lieutenant (MC) U. S. N.

STANLEY L. WALLACE, M. D.

and

RALPH E. FAUCETT

Lieutenant (MC) U. S. N.

IT IS frequently necessary, especially in wartime situations, to administer large amounts of fluids parenterally in very short periods of time. Often the chief indication for fluid administration is to correct dehydration, especially in acute gastro-enteritis or burns (1).

One of the possible future indications for massive fluid therapy is to counteract the body damage of atomic bomb explosions. According to LeRoy (2) the effects of such explosions would include wounds, burns, and radiation injury. Burns of second and third degree would be produced chiefly by exposure to the intense heat generated by the blast and treated as any other flash burns. The main symptoms of severe radiation injury are early intense vomiting and diarrhea, and late hematopoietic manifestations. LeRoy feels that the necessary therapeutic aims in radiation sickness are: (a) maintenance of fluid and acid-base balance; (b) controlling infections; (c) combatting hemorrhagic tendencies; and (d) correcting anemia.

It is not always possible to administer replacement fluids intravenously. Many factors, ranging from inadequacy of available veins to the unavailability of experienced personnel, may make it mandatory that fluid be given by hypodermoclysis. For example, after the atomic bomb blasts in Hiroshima and Nagasaki, a large section of the population was in need of immediate care (2). Many of the patients were suffering from burns and the vomiting and diarrhea of radiation sickness and required supportive fluid therapy. A sufficient number of experienced medical personnel to administer intravenous fluids to all cases undoubtedly were not available. In such circumstances it would appear to be lifesaving to provide an easy and technically simple method for the administration of plasma, dextrose, saline, or other solutions to these casualties, without adding further trauma or discomfort to these patients.

An enzyme, hyaluronidase, has recently been shown clinically to accelerate markedly the absorption of fluids given subcutaneously. We have seen in adults that isotonic solutions of saline can be given as rapidly as 100 drops per minute (400 cubic centimeters an hour, approximately) with little swelling or discomfort.

The enzyme, hyaluronidase, found in bacterial organisms, sperm, and tissue cells, especially those of the testis, acts to hydrolyze hyaluronic acid; the latter has been isolated from the viscid ground substance among the cells of connective tissue. This ground substance acts as a barrier to penetration and the spread of foreign material and fluids in the connective tissue. The hydrolysis of hyaluronic acid by hyaluronidase, therefore, decreases the viscosity of the ground substance, permitting fluids to spread through the connective tissue, reach a greater capillary bed, and be absorbed into the general circulation more readily.

Hyaluronidase has been shown to be nontoxic (3) (4) and when purified to be nonallergenic. The technique of its administration is simple; 0.02 milligram of hyaluronidase in solution is injected into the rubber tubing of the hypodermoclysis set as close to the needle as possible. The clysis is then started. This should permit rapid absorption of the fluid from the sites of administration for from 24 to 48 hours with little tissue swelling or discomfort to the patient.

Two cases are selected to show the value and ease of use of the enzyme.

CASE REPORTS

Case 1.—S. C., aged 36 years, was operated upon for fibromyomata of the uterus and required postoperative fluid therapy for dehydration. One thousand cubic centimeters of 5 percent dextrose in water were given by hypodermoclysis with added hyaluronidase during a period of 3 hours and 10 minutes. Little swelling was noted and the patient complained of no discomfort.

Case 2.—H. R., a 7-pound newborn-infant, developed a cephalhematoma with suspected brain injury and required parenteral hydration and nourishment. Over a period of 5 days he was given a total of 1,850 cubic centimeters of fluids by hypodermoclysis with added hyaluronidase.

DISCUSSION

Although hyaluronidase is available for limited clinical use only at present, it should be of great value to military and civilian medicine. It enables fluids to be given by hypodermoclysis and to be absorbed as rapidly as the usual intravenous administration without significant subcutaneous swelling. Solutions of isotonic saline, of 5 percent dextrose, plasma, and one-sixth molar sodium lactate and others can be given by this means.

Obviously hypodermoclysis cannot be considered a complete substitute for intravenous therapy. It can, however, be an adjunct form of fluid administration; it can be used for maintenance therapy after

the shock crisis is past; and if for any reason intravenous fluids cannot be given, it can be used as an alternate method of administration.

Although hyaluronidase has not appeared to have an untoward effect on seriously ill patients (3) (4), the fact that certain viruses and bacteria facilitate their spread through the tissues by the release of hyaluronidase should be kept in mind in evaluating the drug.

In burns and in severe gastro-enteritis, subcutaneous fluid administration with hyaluronidase can be of much value. Immediate replacement of fluid loss in such conditions is an emergency measure. When the number of casualties is excessive and assumes epidemic proportions, experienced medical officers and corpsmen may not be able to handle the situation. In such instances unskilled individuals may be required to do a large part of the work. It is far simpler to place and maintain a needle under the skin than to introduce it into a vein. Any method by which hypodermoclysis can be advantageously substituted for the intravenous administration of fluids can save much needed manpower during emergencies and the use of hypodermoclysis with hyaluronidase may be such a technique.

REFERENCES

1. WARE, R. L.: Diseases of leading importance to the Navy, U. S. Nav. M. Bull. 48: 153-160, Mar.-Apr. 1948.
2. LEROY, G. V.: Medical sequelae of atomic bomb explosion. J. A. M. A. 134: 1143-1148, Aug. 2, 1947.
3. HECHTER, O.; DOPKEEN, S. K.; and YUDELL, M. H.: Clinical use of hyaluronidase in hypodermoclysis. J. Pediat. 30: 645, June 1947.
4. SCHWARTZMAN, J.; HENDERSON, A. T. and KING, W.: Hyaluronidase in fluid administration. J. Pediat. 33: 267-273, Sept. 1948.

ACKNOWLEDGEMENT.—The authors wish to express their appreciation to Dr. Reuel A. Benson, Chief of Pediatrics, New York Medical College and Metropolitan Hospital, New York, N. Y., and Dr. Joseph Schwartzman, instructor on Dr. Benson's staff, for their advice and general aid in the preparation of this article.



ROOT CANAL FILLINGS IN INFECTED PULPLESS TEETH

Preliminary Report

NORMAN B. SHIPLEY

Lieutenant Commander (DC) U. S. N.

IT HAS been stated in the literature (1) and textbooks (2) that microscopic findings justify an attempt to treat infected pulpless teeth. An area of bone destruction around the apex is almost always found upon radiographic examination of an infected pulpless tooth; in most cases the condition is one of chronic infection involving portions of the dentin and cementum. It has been demonstrated by Blum (3) and Hill (4) that large areas of periapical bone destruction may disappear after treatment of an infected pulpless tooth. However, it must be kept in mind that the treatment of a tooth with an infected pulp may or may not be successful. The treatment is complicated and the prognosis is uncertain. What are the chances for success in saving such a tooth?

An attempt has been made to treat all upper anterior infected pulpless teeth which have come to the writer's attention and to observe them over as long a period as possible. To follow these cases has often been difficult as only a few patients remained on duty at the station where treated, the others having been discharged from the service or transferred to other stations. In the cases possible to follow, the results have been carefully analysed and an attempt has been made to calculate the degree of treatment success.

PROCEDURE

The methods employed have been kept uniform insofar as possible. After the case has been diagnosed definitely by use of all the diagnostic aids and selected as having a reasonable degree of success, the canal is opened from the lingual, if practicable, and allowed to drain for several minutes using sterile cotton points to dry. With root canal reamers and files, the canal is enlarged until a large file (No. 5 or No. 6) easily enters the canal to its entire depth and through the apex into the granulomatous mass. A small gage needle is then thrust through the apex and attached to a syringe containing penicillin calcium in normal saline. Approximately 5,000 units in $\frac{1}{4}$ cc. are

injected into this area slowly. A sterile cotton point is inserted into the canal, the canal sealed with zinc phosphate cement, and the patient dismissed.

Not longer than 48 hours should elapse between the first and second visit, at which time a local infiltration anesthetic is administered. The rubber dam is not used. The canal is washed with sterile distilled water, dried, soaked with phenol, allowed to stand for approximately 5 minutes, dried, and packed with sterile cotton points. With this accomplished, a semilunar incision is cut in the labial mucosa, the convexity toward the crown of the tooth and approximately 5 millimeters from the gingival crest. This incision should be long enough to permit the operator ready accessibility. With a Hu-Friedy surgical bur, a window is cut in the labial alveolar plate and enlarged by means of an osseous chisel to the limits of the area of involvement or until sufficient access has been obtained. The apex of the infected tooth is amputated at the inferior border of the involved area with a No. 8 or No. 9 round bur according to the technique advocated by Blum (5). The granuloma is then removed by curettage. The socket thus formed is packed thoroughly with sterile gauze.

With this stage of the operation completed, the packing is removed from the pulp canal, which is again swabbed with phenol and alcohol and dried. One thick gutta-percha point and several thin points are selected and placed in a sterile tray. A thin mix of pulp canal sealer is prepared, placed around the thick gutta-percha point and inserted into the canal. As many thin points as possible are then wedged into place. Using a small root canal plugger, considerable force is used directly upon this filling. Warming each instrument in turn, larger pluggers are used until no further condensation of the filling is possible. This results in a well-condensed root canal filling.

Returning now to the socket, the packing is removed and with a warm sharp instrument that part of the root canal filling which has been forced through the stump of the tooth is removed flush with the surface. Penicillin calcium 5,000 units in $\frac{1}{4}$ cc. normal saline is deposited in the floor of the socket, and a cube of fibrin foam of appropriate size is inserted to place. The wound is sutured with dermal 000, several roentgenographs are taken, and the patient dismissed. In 4 days the sutures are removed and a permanent silicate restoration is placed over the root canal filling. The patient is reminded to have complete roentgenographs of the infected tooth taken in 6, 12, 18, and 24 months, and thereafter at less frequent intervals.

RESULTS

It has been found that the average degree of known successful treatment is 40 percent compared with the known failures of 6.6 per-

cent. Those cases still under observation but which are undergoing osseous regeneration represent 53.4 percent of the total.

TABLE 1.—*Statistics on number of patients treated*

Patients	Number cases	Teeth involved	Apicoectomy	Unobserved	Observed
Males	39	45	39	25	14
Females	5	7	6	5	1
Total	44	52	45	30	15

TABLE 2.—*Results of treatment*

	Complete regeneration	Increasing regeneration	Failure	Success	Probable success	Failure
				Percent	Percent	Percent
6 months		6		40	53.4	6.6
12 months	2	1				
18 months	1					
24 months	3	1	1			
Total	6	8	1	40	53.4	6.6

CONCLUSION

Since so few cases have been observed to their completion nothing of a conclusive character on percentage of success for this type of operation can be drawn. Although a comparative lack of uniformity exists, yet with some exceptions the repair is generally completed in 24 months, or else failure results. It appears, however, that a considerable degree of success may be expected and an attempt to save such teeth certainly is well justified.

REFERENCES

1. COOLIDGE, E. D.: Root resection as cure for chronic periapical infection; histologic report of cases showing complete repair. *J. Am. Dent. A.* 17: 239-249, Feb. 1930.
2. KRONFELD, R.: *Histopathology of the Teeth and Their Surrounding Structures*. Lea & Febiger, Philadelphia, Pa., 1933. pp. 176-205.
3. BLUM, T.: Root amputation; study of 159 cases. *J. Am. Dent. A.* 17: 249-261, Feb. 1930.
4. HILL, T. J.: Regeneration of periodontal membrane after root curettement. *Dental Cosmos* 73: 799-801, Aug. 1931.
5. BLUM, T.: Life span of teeth whose roots have been resected. *New York J. Dent.* 15: 60, 1945.



TOXICITY OF LOCAL ANESTHETICS

JOHN D. WALTERS

Commander (MC) U. S. N.

MODERN medical practice frequently entails the employment of local anesthetics for the correction of many different conditions. The average physician develops a sense of security in the use of these drugs that is not fully warranted. This report presents a review of the literature concerning the untoward reactions which may result from the use of these drugs, the precautions necessary for the prevention of such reactions, and the treatment of those that occur. Full credit is intended for the authors of the original articles used as references.

The increase in the use of local anesthetics within the past 18 years is emphasized by a report of Romberger and Ratcliff (1) on 10,000 spinal anesthetics. In this series they found that the first 5,000 were given over a period of 14 years and 1 month, an average of 29.5 per month, or 1 a day. The second 5,000 were given over a period of 3 years and 8 months, an average of 113.6 per month, or about 4 per day. An increase in the number of reactions to local anesthetics might logically be expected to follow their increased use.

Sollmann (2) gives credit to V. K. Anrep for the first thorough pharmacologic investigation of cocaine, but the era of local anesthetics began in 1884 when Koller of Germany used cocaine for operations on the eye. In 1885 Corning (3) used cocaine for spinal anesthesia and in 1889 this work was repeated clinically by Bier of Germany, Tuffier of France, and Matas of the United States. This agent left much to be desired (4).

Procaine appeared in 1904. It is practically nonirritating to mucous membranes or other tissues. When injected subcutaneously, it is equal in power to cocaine. Applied to mucous membranes it is only one-sixteenth as efficient as cocaine but it is only one-tenth to one-fifteenth as toxic as cocaine (5).

Cocaine is derived from the leaves of the *Erythroxylon coca*, a tree native to Peru, Chile, and Bolivia. All other currently employed anesthetic drugs are synthetic substances (6). In spite of the advances in biological chemistry and anesthesiology, toxic reactions are not uncommon and fatalities do occur.

In 1946, Corlette (7) of Australia became interested in the problem of anesthetic deaths and made a comparative study of the mortality incident to 35,612 cases of chloroform anesthetics and 20,012 cases of spinal anesthetics. He found that the over-all mortality rate for spinal anesthesia, as at present known, is three times as great as that of chloroform anesthesia of 50 years ago. The rate for spinal anesthesia was found to be 26.9 per 10,000 and the rate for chloroform was 8.9 per 10,000.

A somewhat similar study of statistics by Waters and Gillespie (8) of the Wisconsin General Hospital, from 1933 to 1942 inclusive, revealed that there had been a total of 51 deaths in the operating room out of a total of 44,891 anesthetics. The highest incidence of mortality was with spinal anesthesia, with an incidence percent of 0.139. Intravenous anesthesia was next with an incidence percent of 0.127.

Miller (9) cites a report by Rygh and Bessesen in which they list 250,895 cases of spinal anesthesia with 75 deaths, or one in 3,345. He quotes Babcock as placing the mortality at 1 to 10,000 in selected cases but 1 in 500 in unselected cases, including the bad surgical risks.

According to Adriani (6) of New Orleans, local anesthetics may be placed into three general groups. The first group, composed of complex esters with one or more atoms of nitrogen in the molecule, constitutes the majority of drugs in common use. The nitrogen may be on the acid or alcohol part of the molecule or both. The basic properties of these compounds are due to the nitrogen. Procaine is an example of this group. The second group, relatively unimportant, consists of phenolic and alcoholic compounds. Examples of this group are menthol, phenol, and benzyl alcohol. Their use is confined principally to surface anesthesia. The third group is composed of complex compounds containing nitrogen and are similar to the ester type of drug in pharmacological and physical behavior but are structurally different. Eucupine, holocaine, nupercaine, and quinine are examples of drugs comprising this group.

The esters derived from para-aminobenzoic acid are the most important of the local anesthetics. When para-aminobenzoic acid is esterified with diethylaminoethanol, procaine (novocaine) results. Other esters of para-aminobenzoic acid and aliphatic alcohols or amino alcohols are anesthesin, amylcaine, butyn, butescin, monocaine, pontocaine and tutocaine. The mechanism of the action of these drugs is unknown, but they exert their effect at the site of their application. It is thought that they may cause a decrease in cell permeability by disturbing the concentration of various ions, i. e., potassium, on the surface layer of the nerve. This is followed by a decrease of electrical conductivity in the nerve and interference with the

transmission of impulses. An ultramicroscopic coagulation of colloids may effect changes in the cell metabolism. Direct contact with cocaine or procaine paralyzes all forms of nervous tissue without preceding stimulation. Sensory nerve fibers require only one-tenth as much of the dose required to paralyze motor fibers, probably because motor fibers are of larger size (5).

Solubility, potency, and toxicity determine the usefulness of a local anesthetic. Those insoluble in water, such as benzocaine, are relatively ineffective (6).

Potency is directly related to the chemical structure of the compound. Any changes in the molecular structure of a compound modify its pharmacologic action. Procaine is changed to pontocaine by shortening the ethyl groups of the ethanolamine portion to methyl groups and by placing a butyl group in the para position on the amino group. If a methyl group is removed from the ecgonine portion of cocaine, its anesthetic properties are lost. Pontocaine (tetracaine), often used in topical anesthesia, is as toxic as cocaine but much more potent and apparently less rapidly removed from the tissues (10).

Toxicity varies with the chemical structure of the drug. Adriani recognizes two types, a general systemic toxicity which appears when the anesthetic gets into the blood stream and a local or tissue toxicity. Fortunately the action of most local anesthetics is reversible and the affected cells regain their normal function once the drug is absorbed or washed away. Some drugs have been known to cause a local toxic reaction which is not reversible. Quinine and some of its derivatives and nupercaine are known to be in this group. The local toxicity of anesthetics varies with the mode of administration and the type of tissue into which they are injected.

The size of the nerve fibers to which the drugs are applied, the blood supply of the tissue, the nature of the tissue and the concentration of the drug all effect its toxicity and potency. In order to prevent conduction in a nerve unit the drug must come into direct contact with nerve tissue.

Clinically a local anesthetic may be employed in several different ways to meet specific requirements, i. e., in the subarachnoid space (spinal block), in the epidural space (epidural block), on a spinal nerve paravertebrally (paravertebral block), along the course of a nerve before it branches (nerve block), to several of its branches after it has divided (field block), and to the nerve endings. When applied to the nerve endings, it is either by injection over a wide area (infiltration) or by application on a membrane in which the nerve endings are distributed (topical). Procaine has no power of penetration and is useless for topical anesthesia. The concentration of

procaine in the epidural space where the nerves are sheathed must be ten times as great as in the subarachnoid space where the roots are naked. Thus it is seen that the power of penetration effects the potency of the drug.

The value of a local anesthetic depends upon its toxicity. The vascularity of the tissue and the concentration of the drug used effect the rate of absorption, and the ease with which the body detoxifies or eliminates the drug determines the rate of disappearance from the blood stream and the cells. The toxicity and potency of a local anesthetic are not necessarily equal, and toxicity is often a difficult value to establish for a drug.

The body either eliminates local anesthetics unchanged in the urine or they are detoxified by the liver and other tissues. When the body detoxifies a drug of the ester type, it is hydrolyzed into the acid and alcohol comprising it. Thus procaine is converted to para-aminobenzoic acid and diethylaminoethanol. Such a drug is less toxic than one which is slowly destroyed or eliminated unchanged. Cocaine is only partially detoxified, a large part of it being eliminated in the urine as the original drug. Detoxification is largely a function of the liver, and liver damage may adversely effect this type of elimination. This may be responsible for variations in susceptibility by many individuals.

It is known that guinea pigs resemble human beings in their inability to synthesize vitamin C. In these animals starvation and vitamin C deficiency results in increased sensitivity to the convulsive action of procaine. It is suggested that liberal administration of dextrose and vitamin C to poor risk and debilitated patients prior to the use of procaine may increase resistance against toxic side effects of this drug (11).

In a study by Richards (12) to determine the effect of the split products of procaine on the convulsions caused by that drug, 100 mg. of procaine hydrochloride per kilogram were given to guinea pigs intramuscularly. Convulsions resulted in 5 to 15 minutes in 80 percent of the animals. If 400 mg. per kilogram of the sodium salt of para-aminobenzoic acid were given intraperitoneally 30 minutes before the procaine, convulsions occurred in only 15 percent of the animals and were less intense. When 400 mg. per kilogram of diethylaminoethanol as the hydrochloride were injected before the procaine, the incidence of convulsions was reduced to 8 percent and the severity of the seizures was markedly decreased. Smaller amounts of the split products had less or no protective effect. Larger amounts had to be used if the dose of procaine was raised. Both split products were tolerated in animals in large doses without eliciting symptoms. Richards and Kueter (13) have shown that a mixture of para-amino-

benzoic acid and diethylaminoethanol is even more effective in reducing the number of convulsions following the intramuscular injection of procaine in guinea pigs than either one alone. Neither compound had an antagonistic effect upon the typical local anesthetic action of procaine upon peripheral nerves and the protective action of these split products was found to be specific against procaine. Richards feels that this supports the assumption that the split products attach themselves to the same receptors on which procaine acts, either directly on the cells of the central nervous system or on some intermediary enzyme component such as cholinesterase, and that there is a competitive inhibition due to structural similarity of the convulsive agent and the inhibitor.

TYPES OF REACTION

Two types of reaction to local anesthetic drugs are recognized.

1. Idiosyncrasy (Adriani), also termed immediate (Lium) (14). This type follows injection or topical application of the drug in small amounts, often much less than necessary for anesthesia. Syncope and signs of circulatory and respiratory failure follow immediately and death is presumably due to cardiac failure. Derbes and Engelhardt (15) believe that the cause of a reaction to a local anesthetic drug in a patient with no previous exposure to the drug, if it is to be considered allergic in nature, must be based on the hypothesis that the person has been sensitized by a previous exposure to a chemically related substance such as phenylalanine and tyrosine and para-amino-benzoic acid (a component of the B group of vitamins). It is believed that the allergic reactions to these drugs are mediated through linkage substances whose identity is as yet unknown.

2. "Reaction" (Adriani) or delayed reaction (Lium). This type is more common and gives a better prognosis. The symptoms arise from the central nervous system, respiratory system and circulatory system and appear in two stages. The first is a stage of stimulation; the second is one of depression. With a large dose the stage of stimulation may be fleeting and unnoticed. Excitement and vomiting are prodromal signs and are accompanied by increased mental keenness resulting from stimulation of the cortex. The unsuspecting may consider these signs as a picture of hysteria in an apprehensive patient. Convulsions may then appear followed soon by depression and paralysis of the central nervous system. The blood pressure is at first increased due to stimulation of the vasomotor center. A fall in the blood pressure signifies depression and paralysis of the medullary centers. At the onset bradycardia may be present due to the depressant action of the drug on the myocardium and from stimulation of the vagus center.

Seevers and Waters (16) consider the train of events occurring in untreated high spinal block to be as follows:

Initial decrease in peripheral resistance to blood flow by vasomotor nerve and skeletal muscle paralysis; decrease in minute volume respiration accompanying intercostal nerve paralysis; inadequate oxygenation of blood; diminished minute volume of blood flow; progressive loss of vascular tone over the whole body and acute cardiac incompetence, both the result of oxygen deprivation; failure of the medullary respiratory mechanism as the nutrient flow of blood becomes inadequate, the latter occurring while the heart is still capable of being revived by oxygenation.

CONTROL MEASURES

Study has shown that the only drugs of therapeutic value that can be added to local anesthetics are vasoconstrictor substances. By their action the absorption of the anesthetic is prolonged and its toxicity decreased. Epinephrine is the most efficient of these drugs.

Depressants such as the barbiturates, paraldehyde and chloral hydrate counteract the central nervous system stimulation. Of all the depressants, the barbiturates are the best; the short-acting ones are more effective than the long-acting. Listed in order of their decreasing effectiveness they are: seconal, nembutal, amytal, phenobarbital, and barbitol. Their action is pharmacological and not chemical as it counteracts only the stimulation of the nervous system and not the depression or the effects on the heart and blood vessels. Overdosage is best treated by an intravenous barbiturate, preferably a short-acting one such as pentothal. Adequate artificial respiration with the addition of oxygen is also necessary. If the patient is in the paralytic state the barbiturates should not be used as they are of no value. The use of stimulants is also contraindicated due to the additional depression which follows such initial stimulation. The prophylactic use of barbiturates does not insure against a reaction but will modify or minimize one should it occur.

No one rule can be stated which, if followed, would eliminate completely the possibility of toxic reactions and fatalities from the use of local anesthetic drugs. There are, however, a few precautions that may be followed in order to minimize such reactions.

1. Insure a high intake of dextrose and vitamin C is debilitated and poor risk patients prior to the institution of procaine anesthesia.
2. Ascertain from the patient whether or not he has ever been subjected to the injection or application of a local anesthetic and whether or not he exhibited any signs of sensitivity to it.
3. Administer one of the barbiturates in double the ordinary dose one-half hour before the operation.
4. Use the least toxic drug.

5. Use the least possible amount of the weakest solution that will do the job.

6. Aspirate before injecting to be sure the injection is not intravascular.

7. Add epinephrine to the solution when infiltrating highly vascular areas.

TREATMENT

Treatment of reactions once they have occurred is limited to:

1. Artificial respiration with oxygen supplied in those patients who have stopped breathing.

2. Intravenous injection of sodium pentobarbital or amytal for the control of convulsions.

3. For impending cardiac failure, epinephrine (0.7 cc.) may be administered very slowly in a saline infusion.

4. Cardiac arrest may be treated by direct massage of the heart through an opening in the thorax or abdomen.

5. Withdraw spinal fluid in cases where spinal anesthetic was used.

SUMMARY AND CONCLUSIONS

1. Toxic reactions to local anesthetics are more common than ordinarily supposed.

2. These reactions are of two types: Immediate (probably on an allergic basis), and delayed (usually due to overdosage).

3. Epinephrine administered with a local anesthetic decreases its toxicity by delaying its absorption.

4. Premedication with one of the barbiturates helps minimize reactions.

5. A careful history concerning the patient's sensitivity to local anesthetics should be taken before administering the drug.

6. Treatment of reactions consists of artificial respiration, oxygen inhalations, and, if necessary, cardiac massage.

7. Future investigation may prove the advisability of administering the split products of procaine prior to the use of this drug in order to minimize or eliminate its toxic reactions.

REFERENCES

1. ROMBERGER, F. T., and RATCLIFF, F. W.: Ten thousand spinal anesthetics; five thousand with ephedrine intrathecally—random comment. *J. Indiana M. A.* 40: 217-219, Mar. 1947.
2. SOLLMANN, T.: *Manual of Pharmacology*. 7th edition. W. B. Saunders Co., Philadelphia, Pa., 1948. p. 263.
3. CORNING, J. L.: Spinal anesthesia and local medication of the cord. *N. Y. Med. J.* 42: 483-485, 1885.

4. LUNDY, J. S.: Factors that influenced development of anesthesiology. *Anesth. & Analg.* **25**: 38-43, Jan.-Feb. 1946.
5. WOOD, H. C., JR. et al.: Dispensatory of the United States of America. 22d edition. J. B. Lippincott Co., Philadelphia, Pa., 1940. pp. 893-895, Procaine hydrochloridum.
6. ADRIANI, J.: Some practical aspects of chemistry and pharmacology of local anesthetic drugs. *South. M. J.* **39**: 143-149, Feb. 1946.
7. CORLETTE, C. E.: Spinal anesthesia and chloroform; comparison of mortality. *M. J. Australia* **1**: 545-547, Apr. 20, 1946.
8. WATERS, R. M., and GILLESPIE, N. A.: Deaths in operating room. *Anesthesiology* **5**: 113-128, Mar. 1944.
9. MILLER, A. H.: Fiske Fund Prize Essay No. LXVI; Anesthetics, their relative values and dangers. *Rhode Island M. J. (supp.)*, pp. 1-51, Sept. 1931.
10. HENDERSON, V. E.: Toxicity of anesthetics. *Bull. Acad. Med., Toronto*, **17**: 113-115, Apr. 1944.
11. RICHARDS, R. K.: Effects of vitamin C deficiency and starvation upon toxicity of procaine. *Anesth. & Analg.* **26**: 22-29, Jan.-Feb. 1947.
12. RICHARDS, R. K.: Competitive inhibition of procaine convulsions by its split-products. *J. Biol. Chem.* **159**: 241, June 1945.
13. RICHARDS, R. K., and KUTTER, K. E.: Competitive inhibitions of procaine convulsions in guinea pigs. *J. Pharmacol. & Exper. Therap.* **87**: 42-52, May 1946.
14. LIUM, R.: Cardiac arrest after spinal anesthesia; report of case with recovery. *New England J. Med.* **234**: 691-692, May 23, 1946.
15. DERBES, V. J., and ENGLEHARDT, H. T.: Deaths following use of local anesthetics in transdermal therapy; critical evaluation. *J. Lab. & Clin. Med.* **29**: 478-482, May 1944.
16. SEEVERS, M. H., and WATERS, R. M.: Respiratory and circulatory changes during spinal anesthesia. *J. A. M. A.* **99**: 961-968, Sept. 17, 1932.



ACUTE APPENDICITIS DEVELOPING DURING PENICILLIN THERAPY FOR A SUPPURATIVE INFECTION

Report of a Case

JOHN R. WEISSER
Captain (MC) U. S. N.

and

ALFRED T. WAGNER
Lieutenant, junior grade (MC) U. S. N. R.

OCCURRENCE of acute appendicitis in patients receiving penicillin therapy for other conditions is probably rare. Literature concerning such an incident is meager.

CASE REPORT

T., E. B., white male, age 19 years, was admitted 3 October 1946 complaining of a draining sinus of his left forearm. The patient gave a history of having received an injury to his left forearm from a hand grenade fragment on 29 July 1945. The fragment was not removed at the time of injury and there was drainage from the wound of entrance for about 6 weeks following the injury.

About 3 weeks prior to this admission, tenderness developed over the site of the fragment. Three days following this a point of drainage developed, which was present on admission.

Physical examination on day of admission was essentially negative except for a 3-inch scar along the dorso-medial surface of the middle one-third of the left forearm, at the distal end of which the fragment could be easily palpated. There was a yellowish purulent discharge from each opening of the sinus which apparently connected with this mass. Temperature was 99° F., pulse 86, respiration 20, blood pressure 118/72. Review of systems was essentially negative. Laboratory studies and Kahn test were negative.

The patient was given penicillin, 20,000 units every 3 hours, in preparation for surgery.

On 5 October 1946, under local (procaine) anesthesia, the foreign body, consisting of a metallic fragment 2 by 1 by 0.5 cm., and sinus tracts were excised. Normal healing ensued.

On 8 October 1946 the patient complained of slight tenderness and pain in his right side and stated that this had been present since 7 October 1946; he thought it to be gas pains. The patient stated that he had a normal bowel movement 7 October 1946, ate breakfast 8 October 1946 without ill effects, and had no nausea, vomiting, or urinary complaints.

Examination at that time revealed temperature 98.6° F., pulse 80, and respiration 20. There was marked tenderness, muscle guarding, and skin hyperesthesia over the right lower quadrant of the abdomen. A complete blood count was normal.

The patient was prepared for surgery and the dose of penicillin was increased to 60,000 units every 3 hours.

At operation straw-colored peritoneal fluid was noted. The appendix was loosely bound down, acutely inflamed, and the distal end lying free in the right lateral gutter was markedly enlarged. A small pocket of pus was noted between the mid-portion of the appendix and the cecum. Appendectomy was performed. Five grams of sulfanilamide crystals were placed in the right lateral gutter. The abdomen was closed without drainage.

Upon return to ward patient received intravenously 5 grams of sodium sulfadiazine in 1,000 cc. of 5 percent dextrose in distilled water. Penicillin was continued, 60,000 units every 3 hours for 6 injections and then reduced to 30,000 units every 3 hours.

The evening of the first postoperative day the patient developed an erythematous rash over the surface of the entire body. The blood sulfa level was 7.9 mg. The temperature rose to 99.8° F. The patient gave a history of previous sulfa therapy by oral administration without untoward effect. The white blood count was 18,900 with 85 percent neutrophils and 15 percent lymphocytes at this time.

On the morning of the second postoperative day the temperature was 98.8° F. with an afternoon elevation to 100.5° F. Following this the temperature, pulse, and respiration remained normal. The white blood count on the fourth postoperative day was 9,100 with 89 percent neutrophils, 10 percent lymphocytes and 1 percent eosinophils.

Penicillin was discontinued on the sixth postoperative day, the patient having made an uneventful recovery. Complete blood count 1 month after operation was within normal limits.

The smear of the peritoneal fluid revealed a few white blood cells, much mucus, many gram-positive cocci and gram-negative bacilli. The culture of this material revealed an almost pure growth of gram-negative bacilli.

PATHOLOGIST'S REPORT

Gross examination.—15 October 1946.—The specimen consists of formalin-fixed appendix measuring 9 cm. in length. The distal 3.5 cm. is bulbous and measures up to 2.0 cm. in greatest diameter. The proximal portion measures 0.7 cm. in diameter. The serosa is markedly congested and covered by a fibrinous exudate. On cut section the dilated distal portion is found to contain a fecalith measuring 1.4 cm. in diameter and considerable purulent material.

Microscopic diagnosis.—Acute suppurative appendicitis.

COMMENT

It is known that once an infection of the appendix is in progress, relatively small doses of penicillin, e. g., 20,000 units every 3 or 4 hours, will not in all cases prevent the formation of intraperitoneal abscesses, but it appears at least unusual for an infection to begin and progress to abscess formation during such therapy.

It is regretted that bacteriologic examination of the discharge from the old sinus of the forearm was not done. The etiologic relationship of the old infection is, therefore, conjectural.



ACUTE APPENDICITIS DURING PENICILLIN THERAPY FOR SYPHILIS

Report of a Case

MARVIN L. GERBER

Lieutenant Commander (MC) U. S. N.

IN view of recent reports describing the apparently beneficial effects of penicillin on peritonitis and appendicitis, it might be advisable at this time to caution against too much reliance on such a procedure. The following report illustrates a case of acute appendicitis occurring in a patient while he was receiving penicillin for syphilis.

CASE REPORT

A 20-year-old white male was admitted to the hospital on 18 May 1946 with the diagnosis of Syphilis, Latent. He had acquired a penile chancre in December 1944 and was treated with 2.4 million units of penicillin. In October 1945 he had a positive blood Kahn test and was treated with 5.0 million units of penicillin before being returned to duty. In May 1946 he was found to have a positive Kahn at the personnel separation center, and was sent to the hospital for further examination and treatment.

Physical examination on entry here revealed no notable positive findings. Temperature was 98.6° F., pulse 80, respiration 18, and blood pressure 136/88. Blood Kahn test was positive (4+) and spinal fluid negative.

On 21 May he was given penicillin 40,000 units every 3 hours intramuscularly. On 28 May he completed a course of 2.4 million units. On 30 May another course of penicillin in the same dosage was begun, and on 31 May he was given mapharsen 0.06 gram twice a week.

On 2 June he began to have abdominal pain, and on 3 June presented the typical symptoms and signs of acute appendicitis. At this time he had received 960,000 units of the second course of penicillin. Laparotomy was performed and the appendix found to be acutely inflamed, distended with purulent exudate and surrounded by an area of local peritonitis. The appendix was removed and recovery was uneventful.

Antiluetic therapy was continued without interruption, and penicillin was discontinued on 21 June after a total of 7.2 million units. He was discharged to duty on 26 June, to continue treatment with arsenic and bismuth.

SUMMARY

A case of acute appendicitis coming on during penicillin therapy for latent syphilis is reported. At time of appendectomy the patient

had been receiving penicillin for 13 days for a total of 3.36 million units.

REFERENCES

1. THOMAS, J. R., and THOMPSON, F. G., JR.: Penicillin in treatment of fulminating general peritonitis; report of confirmed case. U. S. Nav. M. Bull. 46: 1113-1116, July 1946.
2. LOWRY, E. F., JR.: Penicillin in acute appendicitis; report of case. U. S. Nav. M. Bull. 41: 1122-1123, July 1946.



PENICILLIN IN TREATMENT OF SYPHILIS

The Syphilis Study Section of the National Institute of Public Health studied types of penicillin (G, F, X, and K) and found penicillin G, which is available in crystalline form, to be the most effective. Penicillin K is considered the least effective because of its rapid inactivation and its anomalous pharmacologic behavior in vivo.

The Jarisch-Herxheimer reaction appears in about 50 percent of primary and secondary syphilis treated with penicillin. The reaction occurs within 12 hours after treatment is started and lasts up to 24 hours.

Early syphilis is suggested in those patients under treatment with penicillin for gonorrhea in whom a sharp febrile reaction occurs within the first 24 hours of treatment.—Abstracted from SYPHILIS STUDY SECTION, NATIONAL INSTITUTE OF PUBLIC HEALTH, U. S. PUBLIC HEALTH: The status of penicillin in treatment of syphilis (December 1, 1947). Council on Pharmacy and Chemistry Section, J. A. M. A. 136: 873-879, March 27, 1948.

REACTIONS FROM PENICILLIN

With Case Report of One Fatality

EDWIN E. BARKSDALE
Commander (MC) U. S. N. R.

DWIGHT M. FROST
Lieutenant, junior grade (MC) U. S. N. R.
and

JAMES J. NOLAN
Lieutenant, junior grade (MC) U. S. N. R.

PENICILLIN is capable of producing two types of reaction: (1) therapeutic shock as manifested by the Herxheimer reaction in syphilis; and (2) an allergic reaction. The Herxheimer-like reaction may also occur in other diseases due to penicillin-susceptible organisms. Penicillin has an amino-acid-like structure, and can act as an allergin just as any other protein.

HERXHEIMER REACTION

In a series of cases of early syphilis treated with penicillin in a naval hospital, a Herxheimer reaction occurred in approximately 30 percent of the cases. This was manifested by malaise, fever and chills, either separately or in combination. One should recognize that this occurs and is of no significance, and is no indication to discontinue the penicillin.

In late syphilis, the Herxheimer reaction may be very serious and even fatal. One case of syphilitic meningitis, whose chief complaint on admission was headache, was thrown into convulsions after therapy was started with a large dose of penicillin. Penicillin therapy was not discontinued. The patient, however, continued to have periodic convulsions for 5 days, and when they ceased the only residuum was extreme exhaustion. In one case of interstitial keratitis, it was felt that the giving of large doses of penicillin at the outset may have produced a total blindness in one eye. One patient with syphilitic myelitis, who complained only of weakness and who presented only diminished reflexes, became paralyzed from his waist down with loss of both bladder and bowel function within a few hours after receiving a large initial dose of penicillin.

Penicillin reaction in late syphilis can be prevented by beginning treatment with small doses. The following dosage for late latent

and late syphilis is now being used in the majority of the cases: 1,000 units every 6 hours for 24 hours; 1,000 units every 3 hours for 24 hours; 5,000 units every 3 hours for 24 hours; 20,000 units every 3 hours for 24 hours, and then 40,000 units every 3 hours for the prescribed dosage.

ALLERGIC REACTIONS

Urticaria and laryngeal edema.—Urticaria is a frequent complication in penicillin therapy. It may manifest itself while penicillin is being administered, or it may not appear until 7 to 14 days after treatment has been completed. Usually it is so mild and transitory that treatment does not have to be stopped, but it may be of such severity as to necessitate the discontinuance of the drug. Laryngeal edema and asthma may be present with or without urticaria. One should recall that laryngeal edema can be fatal.

Exacerbations of epidermophytosis and epidermophytids.—Penicillin has no place in the treatment of fungus infection per se. Many cases of fungus infection are made worse while receiving intramuscular penicillin. A pompholyx-type reaction involving the palms of the hands and the soles of the feet is frequently noted. These reactions usually disappear when the drug has been discontinued.

Dermatitis venenata.—The local use of penicillin ointments and wet dressings produces a high number of reactions. These are expressed by erythema, vesiculation, and excoriation. The topical preparations also may sensitize an individual to such an extent as to prevent the use of subsequent parenteral penicillin.

In the early days of penicillin therapy, the drug was widely used in ointments and wet dressings for all types of skin diseases. The impression soon followed that it had no particular advantage over previous methods of dermatological therapy. If prolonged, dermatitis venenata is frequently produced.*

Neuritis.—Four cases of central nervous system syphilis while being treated with penicillin and artificial fever, complained of numbness of the small fingers of one or the other hand. A definite sensory involvement of the ulnar nerve could be demonstrated. Two other cases developed drop foot while on penicillin. One cleared up in about 3 months. The other is still present 1 month after penicillin was discontinued.

In all fairness, however, it should be noted that this small group does not absolutely incriminate penicillin. The patients with ulnar involvement received intravenous injections while in the fever cabinet. Both patients with drop foot had toxic conditions and it is possible that the injections of penicillin were made too close to the sciatic nerve.

Dermatitis exfoliativa.—A mild and transitory exfoliative dermatitis is frequently superimposed upon an urticaria.

One patient with fungus infection of the feet and stasis eczema later developed a mild cellulitis and was given penicillin. He developed in turn, an urticaria, an exfoliative dermatitis, and a hemolytic staphylococcus septicemia and died.

The case report follows.

CASE REPORT

B. P., age 52 years, was admitted to this hospital 20 November 1945.

His chief complaint upon admission was an itching eruption of the legs, feet, and upper arms which had been present for more than 2 months.

This patient was on duty in the South Pacific, and was well until September 1945. At that time a dermatitis of the feet developed which was diagnosed as a fungus infection. He became worse on local medications. Local and intramuscular penicillin therapy was instituted. He received 20,000 units, intramuscularly, every 3 hours. A severe generalized vesiculation began soon after penicillin was started. The vesiculation and subsequent oozing continued for 1 month before it subsided, leaving the condition unalleviated. The patient was transferred to the continental United States for treatment.

Physical examination upon admission to this hospital showed no abnormalities except for a dermatitis. The skin of the feet, legs, and arms was hypertrophic, roughened, erythematous, and dry. The treatment with continuous, wet, boric-acid dressings to the affected skin regions was initiated.

On 21 November, a penicillin patch test was negative. Two days later the skin was cleared of debris, and topical penicillin was begun. This was continued for 9 days without ill-effect. On 1 December, intramuscular penicillin was cautiously begun with a dosage of 1,000 units every 6 hours. Seventeen hours after the first intramuscular dose, the patient experienced severe itching of the skin. The penicillin was stopped following administration of the fifth intramuscular dose. Thereafter, his skin condition became steadily worse, and his course was progressively downhill.

The involved skin areas became more erythematous, oozed more, and bullae appeared on the skin of the thorax on 5 December. He now had a very definite widespread exfoliative dermatitis.

On 8 December he experienced a slightly chilly sensation. His temperature rose, and for 3 days irregularly rose and fell between 99.5° and 102° F. On 11 December, without benefit of chemotherapy, the temperature returned to normal. A blood culture taken at the height of his fever was sterile. White blood cell count was 16,000 on 10 December and 17,000 on 11 December.

On 14 December, a second steplike rise in temperature began. In 2 days the temperature reached 104.2° F. The respiratory rate varied between 25 and 35 per minute. There was no cyanosis. The lung fields bilaterally were full of sonorous râles, but there were no signs of consolidation. Absence of consolidation was confirmed by roentgenogram. Hemolytic staphylococcus aureus was cultured, and sulfonamides in the usual doses with sodium bicarbonate were started. However, a satisfactory blood level was never maintained.

The skin condition remained unchanged. Serum continued to exude. Plasma protein was 6.0 grams per 100 cc., with 4.1 grams of albumin. Three units of plasma were administered. White blood cell count fell to 10,000 on 19 December and to 8,850 on 21 December.

The temperature slowly fell in steplike fashion to normal level on 22 December, but the respiratory rate continued at a level of 30 per minute. Sonorous râles continued to be present throughout both lung fields, but no consolidation was present.

On 23 December the temperature spiked to a peak of 105° F. Respiration rose to 35-38 per minute. The patient's condition remained essentially unchanged until 26 December, when he became increasingly cyanotic and died.

Autopsy findings were: Interstitial hepatitis; interstitial nephritis; exfoliative dermatitis. Cause of death: Staphylococcus septicemia.

DISCUSSION

In this article no attempt was made to present a statistical analysis of the penicillin reaction rate, the idea being only to present observations made after a little over 3 years' experience with penicillin therapy in the general hospital, during which time approximately 10,000 patients have received penicillin.

In the early days it was felt that the reaction rate was practically nil. That original idea cannot now be substantiated. It is felt that the over-all reaction rate is approximately 8 to 10 percent of the cases receiving penicillin. It is true that by far the majority of these are mild and transitory, but serious reactions can occur. It is felt that the danger of the Herxheimer reaction in latent and late syphilis is a real menace.

The case report illustrates that the institution of penicillin in a previously sensitized individual is an extremely dangerous procedure. The citation of the case of syphilitic myelitis also illustrates the inadvisability of administering penicillin until it is proved that one is dealing with a penicillin-susceptible organism. The indiscriminate use of penicillin is wrong. The use of penicillin on the skin should, in all probability, be discontinued.

No attempt to discredit the value of penicillin has been made. Its misuse should be discouraged.



DELAYED REACTION TO PENICILLIN¹

Report of Four Cases

JAMES L. WELLS

Commander (MC) U. S. N.

and

W. P. LAIRD MYERS

Lieutenant, junior grade (MC) U. S. N. R. (Inactive)

DELAYED serum sickness-like reactions to penicillin are not of rare occurrence in our recent experience. However a review of the literature by Gordon (1) showed that only a small number of cases of this type of reaction have been reported. Four cases corresponding to his description occurred at a naval dispensary during a 3-month period. Either this type of penicillin reaction is not so rare as the literature leads one to surmise, or it is becoming more common during the recent months of repeated penicillin therapy.

In a 3-month period, 181 patients were treated with penicillin for various illnesses at a naval dispensary. Of the 4 cases reported in this article, 3 were from our own penicillin-treated cases, while the fourth received his penicillin course elsewhere. Our incidence of reaction, therefore, is 3 cases out of a total of 181, or 1.7 percent.

CASE REPORTS

Case 1.—A. E. This patient is a 21-year-old white male admitted to the dispensary for treatment of early syphilis. He received 2,400,000 units of penicillin, 40,000 units being given every 3 hours intramuscularly, for a total of 60 doses. The calcium salt of penicillin was used. Course of treatment was uneventful and was completed in 7½ days.

Five days after completion of treatment, the patient began to experience itching of the palms of the hands and the soles of the feet. The following day urticarial wheals appeared on his hands and feet and rapidly spread to involve entire body. The pruritus became increasingly severe and was associated with arthralgia, malaise, and local edema of the hands, feet, and eyelids. There were no symptoms referable to respiratory, cardiac, or gastro-intestinal systems. He gave no history of hives, asthma, hay fever, or eczema; however, he had been treated with penicillin for gonorrheal urethritis 16 months previously. There was no history of recent inoculations or parasitic diseases. No family history of allergy.

On admission to the ward the patient's temperature was found to be slightly elevated, 100° F. His pulse was 76 and respirations 20. He had raised urticarial wheals, both circumscribed and confluent, over the palms, soles, back, arms, and

¹ Received for publication 25 October 1946.

legs. There was moderate edema of the palms, soles, and eyelids. The elbow and knee joints were slightly stiff but there were no signs of articular effusion. The rest of the physical examination was not abnormal.

The patient's temperature remained elevated for 24 hours and then subsided to normal during the following day. He had a mild leukocytosis (10,750) with a normal differential (no eosinophilia). Treatment included abundant fluids, vitamin K, propadrine hydrochloride, epinephrine, and sedation. His symptoms gradually regressed with no dramatic symptomatic relief from any of the above-named therapeutic agents, and he was discharged 4 days after admission. Subsequently this patient developed wheals at pressure sites (e. g., brim of shoes, etc.) on several occasions.

Case 2.—E. M. A 33-year-old white male, was found to have latent syphilis in December 1945. He received 2,400,000 units of calcium penicillin administered in 60 injections, 40,000 units per injection. He exhibited no unusual reaction to the penicillin at that time.

Seven months later, he was again admitted to the dispensary for further treatment of latent syphilis because his Kahn test was still positive (four plus). He received 8,000,000 units of calcium penicillin given in 80 injections, 100,000 units per injection. On the day of completion of penicillin treatment the patient developed extreme itching of the hands and feet, marked edema of hands and fingers, and periorbital edema. Scattered urticarial wheals appeared over his body. Malaise, intense pruritus, and mild arthralgia were prominent symptoms. His temperature, pulse, and respirations remained normal at that time.

The patient had not had any previous allergic episodes whatsoever and there was no history of allergy in his family. He had received mapharsen and bismuth injections 6 days and again 3 days prior to the onset of symptoms. However he was given mapharsen and bismuth the day following his 7-day allergic attack, and because he showed no reaction it was felt that the attack was not due to mapharsen and/or bismuth.

His course was afebrile except for an elevation to 99.2° F. on the fourth and fifth days after the onset of symptoms. Treatment consisted of calcium lactate orally, calcium gluconate intravenously, ephedrine, vitamin K, epinephrine, and local calamine lotion. His white cell count and differential were normal. A slow and gradual improvement occurred over a period of 7 days until recovery. No drug appreciably influenced the course of his disease, although intravenous calcium gluconate gave him marked temporary relief of symptoms.

Case 3.—W. H. A 29-year-old male was treated at a naval hospital in August 1946 for an infection of his left index finger. He had two separate courses of penicillin administered intramuscularly, the *first* course separated from the *second* by about 7 days. Information as to the amount of penicillin received and length of courses was not available.

Three days following discharge from the hospital he developed a generalized urticarial rash and severe itching. There was an accompanying puffiness of the eyes, hands, and feet, with stiffness and soreness of his joints. These symptoms gradually increased in severity for 5 days before admission. For 48 hours prior to admission he had a fever of 101° to 102° F. There was no history of previous allergy.

On admission to the ward he was found to have a fever of 100.6° F. His pulse was 106 and respirations 26. He appeared acutely ill. There were numerous urticarial wheals over his entire body with marked edema of eyes, hands, and feet. The elbows and wrists, knees, finger joints, ankles, and toes exhibited limitation of motion and tenderness. There were no signs of fluid in the joints. No

lymphadenopathy was present. The remaining physical examination was not remarkable.

His temperature gradually subsided to normal 5 days after admission to the ward and 10 days after onset of present illness. He had a leukocytosis (11,400) with a normal differential. The pruritus was extremely severe and morphine was required on two occasions to control it. Treatment consisted of the usual regime of abundant fluids, starch baths, anti-pruritic lotions, ephedrine, sedation, epinephrine, intravenous calcium gluconate, and oral calcium lactate. Benadryl was administered (50 mg. three times daily) for 10 days without apparent relief. In fact, as in our other cases, the entire attack pursued its own course without much interference from the therapeutic regime. There was a gradual regression of all symptoms and the patient was discharged 13 days after admission.

Case 4.—J. M. A 22-year-old white male was admitted to this dispensary with complaints of pain, itching, and swelling of the palms of his hands and the soles of his feet over a 3-day period.

Two days prior to the onset of these symptoms, the patient had completed a 5-day course of sodium penicillin for a perirectal abscess, a total of 1,440,000 units having been given.

His present difficulties began with a small urticarial wheal on the right thumb. Pruritus and swelling rapidly involved the palms and soles in the course of the next 3 days.

The patient gave no history of recent allergy although several times during his childhood he had had transient urticaria attributed to cucumbers. He also had had penicillin for various illnesses on three previous occasions—2½ months ago (400,000 units), 5 months ago (150,000 units), and 11 months ago (100,000 units).

On admission to the ward the patient's temperature, pulse and respirations were normal. He had irregular urticarial wheals over the palms, soles and above the right eyebrow. These lesions were tender to palpation. There was some stiffness of the interphalangeal joints.

The white blood count and differential were normal (no eosinophilia). The urine was normal except for large numbers of white blood cells.

The patient was treated with epinephrine, vitamin K, calcium gluconate intravenously, ephedrine sulphate, abundant fluids, and calamine lotion locally. None of these gave other than temporary relief. During the following 5 days his symptoms gradually subsided. At no time after admission was this patient's temperature elevated.

DISCUSSION

Consideration of these four cases reveals certain interesting features. All four reactors had previously received courses of penicillin (table 1). Although our number of cases is small and uncontrolled factors are present, there is suggestive evidence that this type of delayed reaction was in part due to previous sensitization by penicillin. These views are in contrast to those of Kolodny and Denhoff (5) who could find no correlation between previous penicillin administration and the incidence of reactions. The time intervals between the previous course and the present one varied from 1 week to 16 months. Hence we are unable to draw any definite conclusions as to time required for induction of the allergic state.

In three of the cases (table 1), the number of previous and present courses of penicillin are known. From the table it can be seen that large doses of penicillin preceded the onset of delayed reactions in our patients.

TABLE 1

	Number of previous courses of penicillin	Interval between last course and present course of penicillin	Amount of previous courses of penicillin	Amount of present course of penicillin preceding onset of present illness
A. E.	1	16 months	100,000 units	2,400,000 units.
E. M.	1	7 months	2,400,000 units	8,000,000 units.
W. H.	1	1 week	Unknown	Unknown.
J. M.	3	2½ months	(1) 400,000 units (2) 150,000 units (3) 100,000 units	1,440,000 units.

TABLE 2

Patient	Days from end of penicillin course to onset of present illness	Duration of illness (days)	Presenting complaints	Arthralgia	Fever	Pruritus	Edema of hands, feet, and eyelids
A. E.	5	7	Rash and itching of palms and soles.	Moderate	100.2° F. at onset of illness.	Severe	Moderate.
E. M.	0	9	Same	Mild	99.2° F. 4 to 5 days after onset of illness.	do	Do.
W. H.	3	18	{ Generalized urticaria. Pruritus and arthralgia.	{ Severe	101.4° F. at onset of illness.	do	Do.
J. M.	2	8	Itching and rash of palms and soles.	Mild (fingers).	None	Moderate	Slight (hands only).

Our patients presented much the same clinical picture as has been reported previously in reactions of this type. The clinical syndrome was as follows (table 2) :

1. There was a period of delay in three of the four cases of from 2 to 5 days before the onset of symptoms. The fourth case (E. M.) developed symptoms on the day of completion of a 10½-day course of penicillin.

2. The duration of the attack varied from 8 to 18 days, and was not shortened by any therapeutic regime.

3. The presenting symptoms were a rash and itching of the palms and soles in three cases. The fourth case (W. H.) presented, in addition to this, a generalized urticaria and pruritus at the onset.

4. Arthralgia was present in all cases to a varying degree and most commonly involved the small joints of the hands, although larger

joints were also affected. Articular effusions were not found in any of the cases.

5. Fever was present soon after the onset of symptoms in three of the cases but only mild elevations were noted.

6. Puffiness of the eyelids, hands, and feet were noted in three cases. The fourth (J. M.) had mild edema of the hands only.

7. No dermatologic manifestations other than urticaria were noted in these cases.

The calcium salt of penicillin was used in two cases and the sodium salt in the third. We did not find any correlation between the type of penicillin salt used and the frequency of reaction.

It is to be noted that in case 3 (W. H.) benadryl was administered in 50 mg. doses three times a day for 10 days without appreciable benefit. Admittedly, larger doses should have been tried, for as Scheinberg (2) reports he obtained complete relief on the second day in one of his penicillin reactors by administering 200 mg. of benadryl the first day and 500 mg. on the second day.

We are not prepared from this report to draw any conclusions as to the mechanisms involved in this delayed type of reaction. We do lean toward the viewpoint however, that the reactions are due to the penicillin per se rather than impurities because (a) fairly purified products are on the market at present and (b) batches from different manufacturers were used in these cases.

SUMMARY AND CONCLUSIONS

Four cases of delayed serum sickness-like reactions to penicillin have been presented. Three of these 4 cases occurred among 181 patients treated for various illnesses with penicillin at a naval dispensary in a 3-month period. This is a reaction incidence of 1.7 percent.

Previous reports in the literature of this type of reaction have been meager, and it is our belief that they are of much more frequent occurrence than perusal of the literature leads one to believe.

The clinical picture which our cases presented corresponds very closely to that described by previous writers namely, after a delay period of 2 to 5 days, urticaria and pruritus—usually beginning with the palms and soles—rapidly became generalized. There was usually a mild leukocytosis but no eosinophilia. Also present were an accompanying low-grade fever, arthralgia, and localized edema. The allergic attacks lasted from 8 to 18 days and were not appreciably influenced by standard forms of therapy.

We feel, for reasons presented, that these cases suggest that penicillin itself is the cause of the reactions rather than impurities involved.

REFERENCES

1. GORDON, E. J.: Delayed serum sickness reaction to penicillin. *J. A. M. A.* 131: 727-730, June 29, 1946.
2. SCHEINBERG, D.: Generalized angioneurotic edema due to penicillin inhalations treated with Benadryl. *J. A. M. A.* 132: 78-79, Sept. 14, 1946.
3. SULLENS, W. E., JR.: Simulating serum-sickness reaction to penicillin. *U. S. Nav. M. Bull.* 45: 752-754, Oct. 1945.
4. MACEY, H. B., and HAYS, T. G.: Allergic reactions to penicillin therapy: report of cases. *U. S. Nav. M. Bull.* 45: 1143-1146, Dec. 1945.
5. KOLODNY, M. H., and DENHOFF, E.: Reactions in penicillin therapy. *J. A. M. A.* 130: 1058-1061, Apr. 20, 1946.

ADDENDUM.—Since this article was submitted for publication one more case of delayed reaction to penicillin has been seen by the authors. This case was not typical of the four reported in this article as the main complaint and physical findings were large urticarial wheals over the thighs and lower abdomen. It was characterized by a delay of 4 days from completion of a 2-day course of penicillin, totaling 640,000 units, to onset of symptoms. This patient, as did the others, had had two previous courses of penicillin, 5 months and 14 months prior to the recent course of penicillin. The interesting feature is that Benadryl, 50 mg. every 4 hours was started 24 hours after onset of symptoms and caused a complete disappearance of the urticaria in 48 hours, at which time the patient was discharged to duty.



BENIGN TUMORS OF THE TESTIS

Report of a Case

SPENCER JOHNSON

Captain (MC) U. S. N.

ONE of the remarkable observations in the medical literature of World War II is the large series of testicular tumors reported by numerous medical officers. Vermooten (1) has made a statistical analysis of 62 testicular tumors seen in 2 years at the Brooke General Hospital, Fort Sam Houston, Tex. Col. Earl C. Lowry and associates (2) have made an exhaustive analysis of 100 cases of testicular tumor occurring in the first 27,000 admissions to the Lawson General Hospital, Atlanta, Ga.

Auerbach, et al. (3) of the United States Naval Hospital, Brooklyn, N. Y., found that autopsies performed on patients whose death was due to malignancy of the testis constituted 20 percent of all autopsies in cases of malignant diseases in a 3-year period. This is remarkable when it is recalled that malignant tumors of the testis are generally considered to constitute only 2.09 percent of all malignant tumors of the genito-urinary tract.

The Brooklyn Naval Hospital was one of two naval hospitals designated for the care of neoplastic diseases; 150 beds were there devoted to the treatment of cancer and other malignant diseases. These observations, however, would not seem to presage any actual rise in the incidence of these extremely malignant, embryonal neoplasms.

On thoughtful consideration, the reason for this apparently greater incidence among members of the Armed Forces is doubtless due to the easy access which military and naval personnel have to medical advice and to the frequency of physical examination.

During the past decade, numerous instances of both benign and malignant tumors of the spermatic cord, the epididymis and the tunica vaginalis of the testis and cord have been reported by Thompson (4), Hinman and Powell (5), Oberndorfer (6), Rubaschow (7) (8), Kickham (9), and Meyer (10) and others.

In all available published reports, however, both from this country and from Europe, there has been a notable paucity of instances of benign tumors of the testis.

Included among the 100 tumors reported by Lowry and his associates is only one benign tumor, a fibroma. They make the statement that benign tumors of the testis, such as fibroma, lipoma, leiomyoma, solid and cystic adenoma, dermoid cysts, and benign embryomata are "so rare as to occasion no discussion."

With this marked lack of available reports concerning benign testicular tumors, the writer believes the following case history merits a detailed description.

CASE REPORT

The patient was a 20-year-old radioman, first class, who had enjoyed excellent health all of life. He had had 2 years' service in American waters. His father, mother, and all brothers and sisters were living and well. There was no family history of tuberculosis, carcinoma, or blood dyscrasia.

There was no history of trauma. The patient first noticed an area of hardness in the left testis 13 months prior to admission. This mass had increased progressively and gradually in size and density, although the patient did not believe there had been much change during the past 6 weeks. At no time had pain or tenderness been present. There had been no loss of weight, weakness, nor abdominal discomfort.

Physical examination revealed a robust, young, white male, not acutely ill. No abnormality, whatsoever, was demonstrated except for the testicular new growth about to be described. The vasa deferentia, prostate and seminal vesicles were normal to palpation.

In the upper one-half of the left testis, on its lateral aspect, was encountered a fixed mass of stonelike consistency. It was not attached to the scrotal wall and the testicle itself was freely movable in the scrotal compartment. The mass was approximately spherical and was about 2.0 cm. in diameter. Its edges were so sharply demarcated that at first the presence of a foreign body was suspected. The consistency of the left testicle was otherwise normal and it was of the same size as its normal mate. The possibility of the lesions being gummatous was considered. Serology, however, was normal and there was no history of venereal disease. The spinal fluid was found to be entirely normal.

Roentgenograms of the scrotal contents failed to demonstrate any opacity or other abnormality. The Aschheim-Zondek test was found to be negative. Roentgenograms of the chest were found to be entirely normal. The blood count and urine analysis also were found to be normal.

Accordingly, all clinical and laboratory tests having failed to demonstrate or even suggest the specificity of the lesion, exploration of the left scrotal contents was undertaken under spinal anesthesia. The left scrotal wall was incised and all layers were found to be entirely normal as was the tunica vaginalis testis. On incision of the latter, only a few cubic centimeters of clear, straw-colored fluid were found within its cavity. The left epididymis and the component parts of the left spermatic cord were explored and found to be entirely normal. The tunica albuginea was smooth and glistening; it was not at all adherent to the underlying discrete, stony-hard tumor mass. The tunica albuginea was incised over the tumor mass and the latter dissected from the testicular parenchyma, which was of normal appearance and consistency. The surface of the tumor was of a color paler than that of the surrounding parenchyma and slightly elevated above it. Following extirpation of the tumor, the tunica albuginea was approximated with interrupted sutures of No. 00 chromicized

catgut. The incised tunica vaginalis was everted and the sectioned edges approximated posterior to the testis. A rubber-tissue drain was placed in the left scrotal compartment, the wall of which was closed by interrupted sutures of No. 0 plain catgut and medium black silk. The drain was removed on the third and the sutures on the eighth post-operative day. The postoperative course was entirely uneventful and the patient was discharged to duty 2 weeks after operation. Seven months after operation he was entirely symptom free, there had been no recurrence of the tumor, and the scrotal contents were entirely normal to palpation.

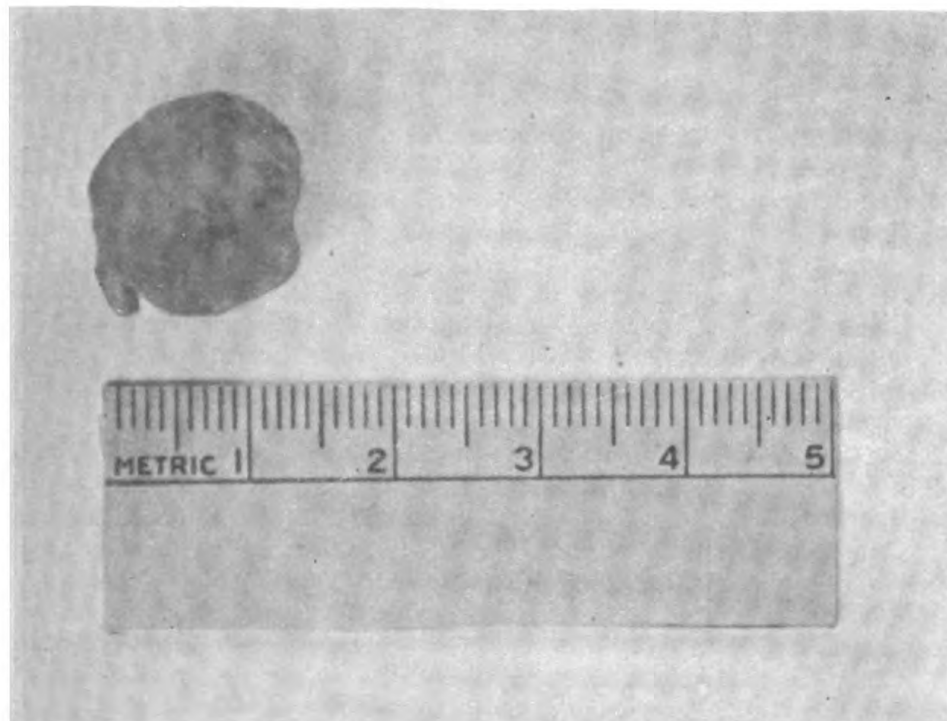


Figure 1.—Gross specimen, anterior surface, as removed.

PATHOLOGY REPORT (Commander Geschickter (MC) U. S. N. R.)

Gross.—The specimen consists of an almost spherical piece of tissue measuring 18 by 15 by 15 mm. It is pinkish white and firm. One side presents a hard nodule somewhat whiter than the remainder, measuring 9 mm. across. Section reveals a firm, pinkish-white surface.

Microscopic.—The tumor is composed of collagenous tissue in a whorled arrangement. It contains numerous fibroblasts with oval and spindle-shaped nuclei. These cells often occur in clusters separated by thick collagenous bundles. No mitotic figures are seen and there is no evidence of malignancy. A few testicular tubules are seen attached to one side of the tumor.

Diagnosis.—Fibroma of testis.

COMMENTS

There is one important commentary, or criticism, which is at once brought to mind by this case history.

807235°—48—6

Opening of the tunica albuginea with a scalpel or with a needle for diagnostic purposes is, in general, not to be recommended. If this is necessary, it is felt by most genito-urinary surgeons, an orchidectomy should be performed and any further exploration done by the pathologist. Testicular tumors, as a group, are extremely malignant and spread both easily and rapidly.

Exploratory operations, except in unusual circumstances, are not therefore recommended. It is far preferable to do an orchidectomy for a benign lesion than to disseminate a malignant one by meddling surgery.

REFERENCES

1. VERMOOTEN, V.: Testicular tumors. *Arch. Surg.* **50**: 63-66, Feb. 1945.
2. LOWRY, E. C.; BEARD, D. E.; HEWIT, L. W.; and BARNER, J. L.: Tumor of testicle; analysis of 100 cases. *J. Urol.* **55**: 373-384, Apr. 1946.
3. AUERBACH, O.; BRINES, O. A.; and YAGUDA, A.: Neoplasms of testis. *J. Urol.* **56**: 368-374, Sept. 1946.
4. THOMPSON, G. J.: Tumors of spermatic cord, epididymis, and testicular tunica; review of literature and report of 41 additional cases. *Surg., Gynec. & Obst.* **62**: 712-728, Apr. 1936.
5. HINMAN, F., and POWELL, T. O.: Management of tumor of testicle. *J. A. M. A.* **110**: 188-190, Jan. 15, 1938.
6. VON OBERNDORFER, S.: Die inneren mannlichen Geschlechtsorgane (Teil 3). In HENKE, F., and LUBARSCH, O. (editors): *Handbuch der speziellen pathologischen Anatomie und Histologie*, Band VI. Julius Springer, Berlin, 1931.
7. RUBASCHOW, S.: Die Soliden Geschwulste des Nebenhodens. *Ztschr. f. Urol.* **20**: 290-297, 1926.
8. RUBASCHOW, S.: Die Geschwulste der Scheidenhaut des Hodens. *Arch. f. klin. Chir.* **141**: 14-26, 1926.
9. KICKHAM, C. J. E.: Report of case of calcified hydrocele simulating tumor. *New England J. Med.* **208**: 869, Apr. 27, 1933.
10. MEYER, C.: Corpora libera in tunica vaginalis testis. *Am. J. Path.* **4**: 445, 1928.



MUMPS ORCHITIS TREATED WITH REACTIVATED POOLED PLASMA

Report of Five Cases

ROBERT E. HUIE, JR.

Lieutenant, junior grade (MC) U. S. N. R.

IN AN outbreak of mumps aboard an assault transport from 9 December 1944 to 26 February 1945, 15 cases of mumps were admitted to sick bay. Five of these patients (33 $\frac{1}{3}$ percent) developed orchitis; of these, the left testicle was involved in 4 and in 1 patient both testicles were involved. All the patients with orchitis were treated with reactivated dried pooled blood plasma intravenously in units of 500 cc. Brief clinical summaries of these 5 cases are given.

CLINICAL SUMMARIES

Case 1.—JLC, 15 Jan.: Swelling began in both parotid and submaxillary regions. Temperature, pulse, and respiration normal.

24 Jan.: Salivary swelling almost completely subsided. Some pain and swelling of left testicle noted. Given 500 cc. plasma.

25 Jan.: Temperature gradually rose to 102.4° F. after the plasma was given. Testicular swelling has increased slightly.

27 Jan.: Temperature has gradually fallen to normal. Testicular swelling unchanged.

1 Feb.: Testicular swelling has gradually subsided to normal. No signs of atrophy.

Case 2.—FSW, 15 Jan.: Slight swelling and tenderness of left epididymis for 2 days, with slight feeling of malaise. Patient gives history of injury to this testicle about 4 days ago. No pain or swelling of salivary glands. Temperature 100.4° F.

16 Jan.: Bilateral parotid swelling has begun. Left epididymis is still swollen and tender, but the testicle itself is not involved. Patient given 500 cc. plasma.

18 Jan.: Left testicle is now swollen and tender. Epididymitis persists. Parotid swelling has increased.

20 Jan.: Temperature rose sharply to 102.4° F. Parotid swelling slowly subsiding. Epididymitis subsiding. No change in orchitis. Given 500 cc. plasma.

23 Jan.: Temperature normal for 3 days. Marked improvement. Parotid swelling has nearly disappeared and orchitis is subsiding.

26 Jan.: Parotitis and orchitis have completely subsided. No noticeable atrophy of testicle.

Case 3.—JRS, 24 Jan.: Patient has had severe malaise and occasional chills for 4 days. For 2 days he has noticed small flat red spots on the dorsal surfaces of his hands and feet. Today he noticed pain and slight swelling of the right testicle and swelling in the left parotid region, with pain on eating. Patient has not had a cold, sore throat, or any other noticeable infection recently. No chest or abdominal symptoms. Temperature 99.6° F.; pulse 60; respiration 20. There are small petechiae on the dorsal surfaces of the hands and feet, on the soles, on the face, and on the buccal mucosa. Tourniquet test positive in 5 minutes. Conjunctivae clear. Throat clear. Heart sounds, rate, and rhythm normal; no murmurs. Chest clear and resonant throughout to percussion and auscultation. Abdomen soft, flat, and nontender, with no organs or masses palpable. Slight swelling in left parotid and submaxillary regions. Right testicle slightly swollen and tender. No lymphadenopathy. No abnormal neurological signs. Urine normal. Erythrocyte count 4,090,000 with 86 percent hemoglobin. Leukocyte count 3,600 with 37 percent segmented forms, 12 percent band forms, 46 percent lymphocytes, 3 percent monocytes, and 2 percent eosinophils. Blood sedimentation rate 1½ millimeters per hour.

25 Jan.: Temperature, 100.2° F. Salivary swelling has markedly increased and now involves the parotid and submaxillary glands on both sides. Both testicles are painful and tender; the left is slightly and the right moderately swollen. No new petechiae. Erythrocyte count and leukocyte count unchanged. Given 500 cc. plasma.

26 Jan.: Patient had chill this afternoon and temperature spiked to 103.0° F. No new petechiae.

27 Jan.: Patient feels slightly better but still has marked malaise. Temperature 101.2° F.

28 Jan.: Symptoms and signs persist. Given another 500 cc. plasma, following which temperature spiked sharply to 104.6° F. No new petechiae.

29 Jan.: Patient had another chill with temperature spike to 104.2° F. Tonight, temperature has fallen sharply to 99.4° F. Symptoms and signs persist.

30 Jan.: Patient feels some better, but temperature again went up tonight to 104.6° F.

31 Jan.: Temperature has remained around 101.6° F. today. Patient feels much better. Testicular swelling and tenderness is much less, but salivary swelling has not changed much.

1 Feb.: After falling to normal, temperature again spiked to 103.4° F. tonight. Patient still feels fairly well. Testicular swelling and tenderness have almost gone, and salivary swelling is receding.

3 Feb.: Temperature dropped sharply to normal today. Patient feels fine. Swelling is receding.

8 Feb.: Temperature, pulse, and respiration normal for 5 days. Testicular pain and swelling and salivary swelling have completely subsided. No evidence of testicular atrophy. Patient has lost almost 20 pounds weight.

Case 4.—AB. 28 Jan.: Swelling in both parotid regions for 1 day, with pain on eating. Temperature, pulse, and respiration normal. No signs of orchitis. Leukocyte count 10,600 with 17 percent lymphocytes. Urine normal.

8 Feb.: Temperature, pulse, and respiration have remained normal. Parotid swelling has practically disappeared, but this morning there is some swelling and tenderness of the left testicle. Given 500 cc. plasma, following which there was a rise in temperature to 101.0° F.

9 Feb.: Temperature 99.0° F. Left testicle still slightly swollen but not very tender.

13 Feb.: Temperature, pulse, and respiration have remained normal. Parotid and testicular swelling have disappeared. No signs of testicular atrophy.

Case 5.—DEM. 3 Feb.: Slight swelling in parotid and submaxillary regions of both sides for 1 day, with pain on eating. Temperature, pulse, and respiration normal. No signs of orchitis.

16 Feb.: Salivary gland swelling has greatly subsided, but there is moderate tenderness and swelling of the left testicle. Given 500 cc. plasma, following which there was a temperature elevation to 100.4° F.

18 Feb.: Temperature has remained 100°–101° F. Salivary swelling has about disappeared and testicular swelling has receded somewhat.

21 Feb.: Temperature, pulse, and respiration normal for 3 days. Salivary and testicular swelling and pain have disappeared. No evidence of atrophy.

COMMENTS

Onset of testicular swelling in these patients varied from the same day to 14 days after the onset of parotitis, with an average of $8\frac{3}{4}$ days (patient FSW not counted in average). All these patients were given plasma as soon as testicular swelling was noticed, except FSW (case 2), who received plasma 2 days before, and patient JRS, who received it 1 day after testicular swelling began. In all but one of the patients there was a rise in temperature within 24 hours of the plasma infusion, in one gradually, and in three sharply. In one of these, however (JRS), there were spikes in temperature without plasma. Three patients received 1 unit of 500 cc. and two patients received 2 units. Decrease in testicular swelling and pain began from 2 to 5 days after plasma infusion, averaging $3\frac{1}{4}$ days (FSW not counted in average). In one (JLC) testicular swelling increased the first day after plasma. In all patients testicular and salivary swelling and pain had completely subsided 1 or 2 days before discharge from sick bay. There were no signs of testicular atrophy at time of discharge. The patients received no other definitive treatment than strict bed rest, ice packs, and suspensories.

In July 1945, approximately 6 months after their discharge from the sick list, these patients were again examined for evidence of testicular atrophy. One patient (FSW) had about 60 percent atrophy of the left testicle, which was soft and flexible. It is noted that this patient had a left epididymitis for 3 days before parotid swelling began, and he was not given plasma before this time. Testicular swelling did not begin until 5 days after the onset of epididymitis and 2 days after onset of parotitis. In no other case was any sign of testicular atrophy noted.

SUMMARY

1. Five patients with mumps orchitis were treated with 500 to 1,000 cc. of reactivated pooled plasma in addition to bed rest, ice packs, and suspensories.

2. Testicular swelling began to subside in from 2 to 5 days (average $3\frac{1}{4}$ days) after plasma infusion, and completely subsided before discharge from sick bay.

3. There were no signs of testicular atrophy in any of the patients at the time of their discharge from the sick list, and after 6 months testicular atrophy was found in only one of the patients. This patient had epididymitis for 5 days before orchitis began and 2 days before plasma was given.



TREATMENT OF SIMPLE FRACTURES OF THE ANKLE

In fractures of the malleoli with displacement, the foot is often displaced backward as well as outward or inward on the leg. In instances of fracture of the external malleolus with outward displacement there is usually an associated rupture of the internal lateral ligament or an avulsion of the internal malleolus; if there is an inward displacement of the foot the external lateral ligament or the external malleolus is similarly involved. In backward displacement of the foot the posterior margin of the distal end of the tibia may be broken off and carried backward—if small its anatomic reduction is not important, but if the fragment is of such size as to involve one-third or more of the distal articular surface of the tibia, anatomic reduction is necessary if a satisfactory result is to be obtained.

A diastasis of the tibia and fibula may occur in displacements of the foot. If a diastasis of over one-eighth inch is not connected, permanent instability and later traumatic arthritis will result.—Abstracted from Key, J. A.: Treatment of simple fractures of ankle. J. Missouri M. A. 44: 270, April 1947.

GLOMUS TUMOR

With Report of a Case¹

RALPH A. DOWNS, JR.

Lieutenant, junior grade (MC) U. S. N. R.

THE glomus tumor is at present considered a relatively rare lesion and is not readily recognized by physicians who have not previously encountered a case. Because of this, patients are usually subjected to prolonged periods of disabling pain before the diagnosis is made. Since a cure is almost always assured by surgical excision, it behooves the profession to publicize the condition by further case reporting. Adair (1) states that 8 out of 10 cases that he reported had an average duration of 8 years.

PATHOLOGY

The glomus tumor is an enlarged or hypertrophied glomus. The glomus is a specialized arteriovenous anastomosis which is present normally in the dermis or subcutaneous strata of the skin. It consists of tortuous blood vessels which are lined with two or three layers of endothelial cells. A thick, smooth muscle layer surrounds the blood vessels. Bailey (2) states that large cells with clear or vacuolar cytoplasm are scattered throughout the muscle layers. These are known as "glomus cells" or "epithelioid cells" and are closely associated with a rich supply of myelinated and nonmyelinated nerve fibers. According to Bailey, the glomus tumor is merely an enlargement of the normal glomus with proliferation of the already existing glomus cells. However, other authors believe that the glomus cells are neoplastic in origin and invade and displace the smooth layer which surrounds the terminal arteriovenous anastomosis.

The majority of the pioneer work and first accurate histological description of the normal glomus apparatus was done by Sucquet (5) and Hoyer (6). Consequently, Masson (7) named the tortuous vessels of the glomus the Sucquet-Hoyer anastomosis.

The physiological function of the normal glomus, first described by Popoff (8), is to regulate local and general body heat and to regulate blood pressure.

¹ From the Surgical Service, U. S. Marine Hospital, Mobile, Ala. Article read before the staff of the U. S. Marine Hospital, Mobile, Ala., 3 June 1948.

HISTORY, ETIOLOGY, AND INCIDENCE

The glomus tumor was first described as such by Masson (7) in 1924. Undoubtedly, however, it had been described many times previous to that as a "painful subcutaneous nodule" or by some other clinical term. Ewing (9) states that Wood described the lesion as early as 1812.

Beaton and Davis (10) in 1941 collected 271 cases from the literature and evaluated the incidence as to anatomical location and sex. By reviewing the case reports in the Quarterly Cumulative Index Medica of the American Medical Association from 1941 to 1947, it is estimated that approximately 40 additional cases have been reported during that time. Consequently, it can be estimated that the number of glomus tumors reported up to 1947 is somewhere in the vicinity of 320 cases.

Beaton and Davis revealed that the majority of lesions occur on the extremities, typically in a subungual position and with progressively less frequency as proximal areas of the extremities are approached. They occur rarely on the trunk, head, and genitalia. The incidence in male and female has been found to be approximately equal.

The causation of the glomus tumor has not as yet been determined. Several authors (11) (12) have stated that the history of trauma is present in most cases. Grauer and Burt (11) estimated that from 40 to 50 percent of the cases are due to trauma. It is thought also that there may be a congenital predisposition of the terminal arteriovenous anastomosis toward formation of the lesion since Kaufman and Clark (12) in 1941 reported four cases of glomus tumors in different members of the same family. Adair (1) speculates that patients who have the lesion must have a tumor tendency since 5 out of the 10 cases that he reported had other types of subcutaneous tumors.

SIGNS AND SYMPTOMS

In most instances there is a small palpable subcutaneous tumor, not exceeding 1 cm. in diameter. In advanced cases these tumors are associated with paroxysmal pain which usually radiates proximally from the lesion. The site of the nodule is typically a "trigger point," sensitive to minimal trauma or to changes in environmental temperature, especially cold. The association of a palpable tumor with paroxysmal shooting pain is regarded as the cardinal symptom of the condition. At first the pain may be moderate or merely a sensation of paresthesia that remains localized at the site of the tumor; however, as the lesion develops the pain increases in severity, radiates more and more widely, and occurs with greater frequency. In severe cases the condition has been mistaken for angina pectoris.

Usually there is also a cyanosis of the overlying skin and a definite change in the skin temperature at the site of the lesion. In most instances the overlying skin has a relatively lower temperature than that of uninvolved areas.

In some instances the tumor is not palpable, especially when it is in a subungual position. In this case the diagnosis is less obvious.

CASE REPORT

A well-developed, well-nourished, 52-year-old adult male was admitted to the hospital complaining of severe paroxysms of "shooting pain" of the tip of the left middle finger. This pain, the patient stated, was intermittent and recurrent, and was initiated when he touched an object or when the finger was exposed to cold. This condition had been present for approximately 2 years. It began as a "pins and needles" feeling in the tip of the finger; however, after several months he began having paroxysms of pain which grew progressively more severe and more sensitive to the stimuli of touch or cold. For 3 or 4 months prior to his admission, the slightest stimulus would initiate excruciating pain that would occasionally radiate up his arm. Since the patient had a deformity of the opposite hand, due to an old traumatic amputation of the third, fourth, and fifth fingers, this superimposed condition had practically rendered him totally disabled.

Physical findings were within normal limits except for absence of the right third, fourth, and fifth fingers, and a cyanotic, cold, extremely tender terminal phalanx of the third left finger. This finger tip was noticeably cold as compared to other areas of the hand, and so tender that the slightest palpation was not tolerated by the patient. There was a slight atrophy of the soft tissues of the terminal phalanx. The remaining fingers of the hand were found to be non-tender and equal in skin temperature to that of the opposite hand. The radial pulse was adequate and equal to that of the opposite upper extremity.

Diagnostic procedures:

- (a) A roentgenogram of the finger revealed no foreign body or bone pathology.
- (b) By calorimetric method (thermocouple) the skin of the involved finger tip was found to be 3° C. lower than that of the other fingers and other areas of the same finger.
- (c) Stellate sympathetic ganglion block with cocaine rectified this variation in skin temperature. Following the block the skin temperature of the involved finger tip became equal to that of other areas of the same hand. Incidentally, it was discovered that the finger tip became remarkably less tender and palpation was tolerated by the patient. By this means a small, firm, nodule was felt deep in the substance of the fatty pad of the finger.

Treatment:

Surgical excision under local anesthesia. The lesion was a well encapsulated, firm nodule measuring about 4 mm. in diameter. It was pinkish in color and many small blood vessels entered the tumor at all angles. Following surgical excision, there was complete relief of pain and tenderness.

Pathologic diagnosis:

Glomus tumor.

COMMENT.—At first, because of the character of the patient's pain, a neuroma was suspected. However, when no nodule was found, due to

the inability to palpate the finger tip and because of the temperature change and discoloration, the possibility of a peripheral vascular disease was considered. It was because of this suspicion that a block of the sympathetic ganglion was done as a diagnostic procedure.

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

In typical cases in which the cardinal signs and symptoms present themselves the diagnosis of glomus tumor is not difficult if the physician is cognizant of the condition. However, even under these ideal conditions, one has to differentiate the glomus tumor from other types of subcutaneous nodules that are associated with paroxysmal pain. Stout (3) stated that in a series of 2,081 cases of subcutaneous tumor approximately 1 percent were associated with paroxysmal pain. The various tumors instrumental in producing this clinical picture were glomus tumors, tuberculum dolorosum, solitary leiomyoma of the skin, neurofibroma, fibrosarcoma, keloid, dermoid cyst, fibroma, benign epithelioma in a sebaceous cyst, subungual melanoblastoma and neuroma. The difficulty that presents itself in differentiating the glomus tumor from any of the above-named associated with pain is obvious.

In the case of a palpable subcutaneous nodule that is associated with paroxysmal pain, the determination of the temperature of the involved skin as compared to that of the temperature of an area of uninvolved skin, and the local anesthetization of the corresponding sympathetic ganglion which supplies the part, are of definite diagnostic value. If, in the event there is a reduction of skin temperature over the tumor that is rectified by a sympathetic block, this indicates that the tumor has definite vascular component that has created a local circulatory disturbance. This finding is a definite aid in differentiating the glomus tumor from other subcutaneous nodules associated with paroxysmal pain.

When there is paroxysmal pain of the extremity and a tumor is not readily detected because of its deep position in the subcutaneous tissue, and adequate palpation is not tolerated by the patient due to the excruciating pain initiated by the slightest of trauma (see case report), the "blocking" of the corresponding sympathetic ganglion is again of diagnostic value. Following the block there is a marked diminution of pain and tenderness over the lesion, which allows palpation and detection of the tumor. The fact that there is diminution of pain and tenderness is in itself strongly suggestive of a glomus tumor since the other painful subcutaneous nodules discussed above would not be affected by a sympathetic "block." The explanation of this mechanism by which amelioration of pain and tenderness is obtained by sympathetic ganglion anesthetization is probably due to two mechanisms. First, the nerve tissue that has been demonstrated in

close association with the glomus cells of the tumor must be, for a large part, sympathetic in origin, and by blocking the ganglion the visceral afferent impulses are blocked. Second, the circulation to the tissue that is distal to the tumor which suffers some circulatory embarrassment because of the enlarged arteriovenous shunt is increased and any ischemia that might be contributing to the pain is abolished.

The relationship of the sympathetic nervous system to glomus tumors has been observed in various case reports previously. Ley and Roca de Vinals (14) reported a case of glomus tumor of the index finger that was associated with a Horner's syndrome. Also, variation in sweating is often associated with glomus tumors.

Various other diagnostic procedures have been discussed. Love (15) in 1944 described a "pin test." The trigger point and consequent location of the nodule was found by exploring the suspected area with a pin. The point where maximum pain was initiated indicated the site of the lesion.

Erosion of bone by an adjacent glomus tumor has been demonstrated and is contributory, when present, to the diagnosis.

SUMMARY

1. A case of glomus tumor of left middle finger has been reported as a plea for more readiness in the recognition of the condition.
2. A review of the literature revealed that approximately 320 cases had been reported up to 1947.
3. The history, causation, and pathologic condition found were discussed briefly.
4. The role of the sympathetic ganglion block is described in the diagnosis and differential diagnosis of glomus tumor.

REFERENCES

1. ADAIR, F. E.: Glomus tumor; clinical study with report of 10 cases. *Am. J. Surg.* 25: 1-6, July 1934.
2. LEWIS, D., and GESCHICKTER, C. F.: Glomus tumors (arterial angioneuromyoma of Masson). *J. A. M. A.* 105: 755-778, Sept. 7, 1935.
3. STOUT, A. P.: Tumors of neuromyo-arterial glomus. *Am. J. Cancer* 24: 225-272, June 1935.
4. BAILEY, O. T.: Cutaneous glomus and its tumors—glomangiomas. *Am. J. Path.* 11: 915-935, Nov. 1935.
5. SUCQUET: Quoted by Popoff, N. W. (8).
6. HOYER, H.: Quoted by Popoff, N. W. (8).
7. MASSON, P.: The glomus of tactile regions. *Lyons chir.* 21: 256-280, May-June 1924.
8. POPOFF, N. W.: Digital vascular system, with reference to state of glomus in inflammation, arteriosclerotic gangrene, diabetic gangrene, thromboangiitis obliterans and supernumerary digits in man. *Arch. Path.* 18: 295-330, Sept. 1934.

9. EWING, J.: *Neoplastic Diseases*. W. B. Saunders Company, Philadelphia, Pa., 1940. p. 239.
10. BEATON, L. E., and DAVIS, L.: Glomus tumor; report of 3 cases; analysis of 271 recorded cases. *Quart. Bull. Northwestern Univ. M. School* 15: 245-254, 1941.
11. GRAUER, R. C., and BURT, J. C.: Unusual location of glomus tumor; report of 2 cases. *J. A. M. A.* 112: 1806-1810, May 6, 1939.
12. KAUFMAN, L. R., and CLARK, W. T.: Glomus tumors; report of 4 cases in same family. *Ann. Surg.* 114: 1102-1105, Dec. 1941.
13. STOUT, A. P.: Painful subcutaneous tubercle (*tuberculum dolorosum*). *Am. J. Cancer* 36: 25-33, May 1939.
14. LEY, A., and ROCA de VINALS, R.: Contribución al estudio de los tumores glómicos. *Rev. clín. españ.* 6: 7-12, July 15, 1942.
15. LOVE, J. G.: Glomus tumors; diagnosis and treatment. *Proc. Staff. Meet., Mayo Clin.* 19: 113-116, Mar. 8, 1944.



EPIDEMIC CEREBROSPINAL MENINGITIS (WATERHOUSE-FRIDERICHSEN'S SYNDROME)

Report of Two Successfully Treated Cases and One Fatal Case

FREDERICK W. MEYER, JR.

Lieutenant, junior grade (MC) U. S. N.

THIS syndrome usually affects children within an age-range of 6 months to 9 years. It is marked by sudden onset, with the appearance of headache, malaise, anorexia, abdominal pain, vomiting, and fever; followed by rash, cyanosis, prostration, and death.

It was first described in 1901 as a fulminating hemorrhagic disease of unknown etiology. In 1911, Waterhouse described 1 case of his own and 15 from the literature, and suggested the existence of a definite syndrome. Only in 1916 was an etiologic agent suspected, when *Neisseria intracellularis* was recovered from a case of fulminating cerebrospinal meningitis, of the picture previously described. Friderichsen, in 1918, summarized the literature, and as a result of his work the syndrome was given its name. To date, at least 96 cases have been described (1).

This syndrome has been defined as "the malignant or fulminating form of meningococcus meningitis" (2). This definition was apparently made before the different types of meningococcal infection were postulated, and without recognition that other organisms may be responsible for the adrenal hemorrhage which contributes largely to the clinical picture. The older literature has not recognized, or at least has not stressed the fact that meningococcic infection may take three distinct forms; i. e., the nasopharyngeal, the septicemic, and the true meningitic. It does recognize that from 5 to 80 percent of cases of meningitis do show positive blood cultures as a transient feature; also, that occasionally one does see fulminating meningococcemias. Hence, it is difficult to find figures on the true incidence of this particular syndrome (3).

Whitaker (4) reported a series of 116 cases of meningococcic infection from the U. S. Naval Hospital, Farragut, Idaho. It was found that 25 cases, or 21.5 percent were in the form of meningococcemias; of

these, 4 cases, or 3.4 percent of the total, were classified as fitting the Waterhouse-Friderichsen's syndrome.

Lindsay, et al. (1) give a summary of the pathologic findings as follows:

1. Bilateral adrenal hemorrhage, in 90 percent of cases; this ranging from petechial hemorrhages to gross hemorrhage. Venous thrombosis and bacterial toxins are thought to play a dominant part in the production of hemorrhage.

2. Enlargement of the thymus gland, with small hemorrhages therein.

3. Generalized lymphadenopathy. Besides these glands readily palpable, enlarged bronchial, mediastinal and mesenteric lymph nodes have been found.

4. Splenomegaly.

5. Purpura, ranging from petechiae to ecchymoses.

6. Recovery of the causative organism by culture of heart's blood.

7. Besides the organic changes noted, hypoglycemia and azotemia may occur.

Since the feature of adrenal hemorrhage has been incorporated in the definition of the syndrome, from observations at autopsy, it is readily apparent that there is no way to prove conclusively its presence in the patient who recovers. This point merely accentuates some of the difficulties in the study of this syndrome.

Two cases of fulminating meningococcemia, successfully treated, are herewith presented. A third case, which came to autopsy, is presented from a speculative point of view; certain features observed fit the syndrome as defined. The main purpose of this article is to discuss the cases from the standpoints of diagnosis and early management.

CASE REPORTS

Case. 1.—G. W. I., aged 17 years, was admitted to sick bay with the chief complaint of severe abdominal pain. For several days previously he had had sore throat and headache; while in the sick bay he developed chills, fever, and persistent vomiting. A diagnosis of Diagnosis Undetermined (Appendicitis) was made, and the patient transferred to the hospital. On admission, the patient complained of malaise, severe epigastric pain, and of feeling "stiff all over."

Physical examination revealed an acutely ill patient, perspiring freely. The pulse and blood pressure were unobtainable. A dense, purpuric rash covered the entire body; the conjunctivae showed extensive hemorrhage. The abdomen was negative except for marked tenderness in the epigastrium.

A diagnosis of fulminating meningococcemia (Waterhouse-Friderichsen's syndrome) was made and verified by recovery of the organism from the purpuric lesions. Other laboratory work showed a mild albuminuria, a white blood count of 20,000/cu. mm., a red blood count of 3,240,000/cu. mm., and a blood creatine of 9.6 mg. percent.

Immediate treatment consisted in the administration of adrenal cortical hormone, in the form of desoxycorticosterone acetate and the fluid extract of

the gland; also of penicillin, and solution of 5 percent dextrose in saline. Frequent blood pressure readings were taken, with their values serving roughly as an index for the administration of cortical hormone. The extract was given in 10 cc. doses intravenously, or placed in the continuous infusion (20 cc. or so per liter); the refined hormone, in 5 mg. doses, intramuscularly. Penicillin was added to the infusions, usually 100,000 units per liter. The amounts used are charted on the graph (fig. 1). In the first 2 days after admission, 180 cc. of cortical extract, 20 mg. of the refined hormone, 250,000 units of penicillin, and 5 liters of dextrose solution were given.

The blood pressure readings, temperature, and white blood counts are shown in figure 1 for a 7- to 10-day period. Moderate hypotension persisted for 4 days after admission (average 80 mm. systolic/50 mm. diastolic); however, by the end of 10 days the pressure had become normal and remained that way. The administration of desoxycorticosterone was discontinued after the sixth day.

The patient's course was uneventful for the rest of his hospital stay, except for muscle pains in the extremities. Blood and throat cultures after the second day remained negative for meningococci.

Case 2.—*J. P. B.*, aged 18 years, was admitted to the sick bay with the symptoms of tiredness, weakness, blurring of vision, and diplopia; he had also noticed some "spots" on the dorsum of his hands. There was no localized pain anywhere; he had no gastro-intestinal or genito-urinary symptoms. The patient was transferred to the hospital with the diagnosis of Diagnosis Undetermined (Bacterial endocarditis).

Physical examination showed an acutely ill patient, with a temperature of 102° F. The pulse was imperceptible; the blood pressure 70 mm. systolic/50 mm. diastolic. Petechiae were present over the hands and feet; subconjunctival hemorrhages were also noted. The chest and abdomen were negative. The reflexes were hyperactive, but no Kernig or Brudzinski reflexes were elicited.

The diagnosis of meningococcemia was established by recovery of the organism from the cutaneous lesions. The white blood count on admission was 20,000/cc. mm.; this rose to 40,000/cu. mm. on the second day, but declined steadily after that.

Immediate treatment consisted in the administration of 20 cc. of adrenal cortical extract, 5 mg. of desoxycorticosterone, 500 cc. of plasma, and 30,000 units of penicillin intramuscularly.

Thirty cubic centimeters of the cortical extract were given the second day, and 40 cubic centimeters on the third day; subsequent doses are charted in figure 2. Penicillin was continued in doses of 20,000 units every 3 hours, intramuscularly.

By the end of the fifth day, the patient's blood pressure had returned to normal limits, and it remained that way. Three or four weeks later in his convalescence, the patient developed an arthritis in one elbow, and also pneumonia. Both were also successfully treated.

Case 3.—*D. D. D.*, aged 18 years, was admitted to a dispensary with a history of chills and fever for 4 hours, malaise, and anorexia. The temperature was 104° F.; otherwise, the physical examination was reported as essentially negative. Unfortunately, there is no record of a blood pressure determination. A diagnosis of Acute Catarrhal Fever was made; the patient was put to bed, and 20,000 units of penicillin was given every 3 hours.

About 0100 on the morning after admission, the patient was reported to have gone to the toilet and back to bed, without help. At 0330, when the third dose of penicillin was to be given, the patient was found dead in bed; he had re-

ceived a total of 40,000 units of penicillin. The time elapsed between the onset of symptoms and death was less than 12 hours.

Autopsy

At autopsy the following were observed:

1. No cutaneous lesions were noted by the pathologist.
2. No hemorrhagic lesions of the serous membranes or leptomeninges were noted.
3. Hilar and mesenteric lymph nodes were enlarged.
4. The liver was enlarged, to 2,200 grams.
5. The spleen was enlarged, to 440 grams.
6. Gross hemorrhages were noted in both adrenal glands.
7. A staphylococcus organism was recovered from postmortem culture of heart's blood.

The anatomical diagnoses were: (1) septicemia; (2) adrenal hemorrhage; (3) acute splenic swelling; (4) cloudy swelling of the liver; and (5) perisplenitis.

COMMENTS

Several points regarding diagnosis and early management are to be derived from a study of the foregoing cases:

The signs and symptoms may be so variable as to frequently lead to erroneous diagnosis, and thus to a loss of valuable time. After the usual acute onset which characterizes any febrile illness, certain features begin to emerge which should make one suspect, from clinical grounds alone, a diagnosis of septicemia with the Waterhouse-Friderichsen's syndrome. These are notably, (*a*) cutaneous and/or subconjunctival hemorrhagic lesions; (*b*) signs of prostration and shock, such as thready pulse, hypertension, and perspiration. From the laboratory standpoint, diagnosis is facilitated by obtaining smears and cultures from the cutaneous lesions; this is easily done by injecting a small amount of saline solution with a hypodermic needle, and aspirating from the lesion.

Other considerations to bear in mind are (*a*) careful evaluation of abdominal pain, as to severity and location; (*b*) realization that findings will vary from one case to another (for example, temperature, neurologic findings, cutaneous lesions, location of pain, etc.); (*c*) history of previous cardiac involvement by rheumatic fever, or congenital defects, which may predispose to bacterial endocarditis in later life, and (*e*) keeping in mind this particular syndrome as a manifestation of meningococcic infection, especially in concentrations of susceptible young subjects where upper respiratory infections are rife.

In the early management, certain fundamental pathologic processes must be vigorously combatted as soon as the diagnosis is suspected or established:

1. The role of the adrenal damage in the production of shock must be recalled, and adrenal cortical hormone given freely. As noted above, the purified product may be given intramuscularly; the extract, either

intravenously by itself or in combination with continuous infusions. Variable amounts, ranging up to 150 cc. of the extract, may be required in the first day or two; subsequently, it is used as deemed necessary to stabilize the blood pressure.

2. The septicemia is to be combated in the early stages with a continuous intravenous penicillin drip; 50,000 to 100,000 units to a liter of 5 percent dextrose in physiologic saline solution. (In another case of meningococcic septicemia with mild shock, not reported, 250,000 units of penicillin in 2 days was found sufficient to bring about a negative blood culture.)

3. Supportive measures, chiefly in the form of intravenous dextrose solutions not so much for the shock but because of the inability of the patient to retain food. The possibility of hypoglycemia has been noted above.

4. Restoration of electrolytes lost through vomiting, perspiration, and as a result of adrenal cortical damage. This was done in the above cases by giving up to 6 grams of sodium chloride by mouth per day, when the patient became able to retain nourishment.

CONCLUSIONS

Under conditions where meningococcic infection can become prevalent this highly fatal syndrome must be kept in mind and the patient observed closely, otherwise a wrong diagnosis will often be made.

Once recognized, heroic measures must be undertaken immediately. Too few cases treated with the agents now available have been observed to assemble fair mortality statistics, but it has been shown that patients can recover fully (5).

REFERENCES

1. LINDSAY, J. W., et al.: Waterhouse-Friderichsen syndrome. Acute bilateral suprarenal hemorrhage. *Am. J. M. Sc.* **201**: 263-270, Feb. 1941.
2. DORLAND, W. A. N.: *American Illustrated Medical Dictionary*, 19th edition. W. B. Saunders Company, Philadelphia, Pa., 1942.
3. CECIL: *Textbook of Medicine*, 5th edition. W. B. Saunders Company, Philadelphia, Pa., 1941.
4. WHITAKER, W. M.: Meningococcic Infections. *U. S. Nav. M. Bull.* **43**: 650-663, Oct. 1944.
5. BUSH, F. W., and BAILEY, F. R.: Treatment of meningococcus infections with especial reference to Waterhouse-Friderichsen syndrome. *Ann. Int. Med.* **20**: 619-631, Apr. 1944.

ACKNOWLEDGMENT.—The author wishes to express his appreciation to Capt. J. L. Frazer (MC) USN, Medical Officer in Command, U. S. Naval Hospital, Great Lakes, Ill., for permission to use the case material; to Capt. H. H. Carroll (MC) USN for his suggestions regarding the preparation of this article; and to Miss Louise Lee for assistance in gathering the information herein.

OCCLUSION OF THE CENTRAL RETINAL VEIN

Report of a Case Treated With Heparin

ROBERT C. BOYDEN

Captain (MC) U. S. N.

and

HARRY A. KETTERING

Lieutenant, junior grade (MC) U. S. N. R.

ON 28 March 1946 a 33-year-old Marine, working outside loading trucks with heavy gear suddenly noticed that with the left eye closed, vision in the right eye was blurred. There was no associated pain or any other subjective complaints. The patient thought this was probably due to effects of the sun on his eye and continued working. That afternoon he realized that the blurring was still present in his right eye, and reported to the dispensary. He was transferred to this hospital 10 days after the onset of the above-named symptoms. He stated there had been no change in his vision since the initial blurring. There were no associated complaints.

Physical examination: A well-developed, well-nourished white male in no acute distress. Blood pressure was 100/60 at rest, 120/65 after exercise. Pulse was 75 and regular. Visual acuity in the right eye was 20/300 on admission. Ophthalmoscopic examination revealed a clear cornea, lens, and media. The retina was covered with diffuse radially arranged flame-shaped hemorrhages from disk to periphery and involving all four quadrants. The veins were markedly dilated and tortuous, and obscured in part by the retinal swelling. The disk was gray and edematous. Intra-ocular pressure was not increased to palpation.

The physical examination was essentially negative. A diagnosis of Thrombosis of Central Retinal Vein was made on the finding of involvement of all four quadrants. Indicated laboratory studies were negative.

Search for a causative focus of infection was not successful. Prostate was normal. Roentgenograms of the chest and of the teeth were negative.

Three days after admission, mildly increased intra-ocular tension was present and the patient was given pilocarpine 2 percent three times daily. Eleven days after admission, examination of the eye revealed slight absorption of the hemorrhages, but vision was still 20/300. On 1 April, 24 days after the occurrence of the thrombosis, heparinization was begun.

100 mg. heparin in 100 cc. normal saline was given 4 times daily at the rate of 25 drops a minute. Clotting time by capillary tube method was 2 minutes before the first injection. The thrombocyte count was 218,700 with normal morphology.

Three methods of administration were utilized: (a) four injections a day of 100 mg. heparin in 100 cc. normal saline; (b) continuous around the clock method, at the rate of 100 mg. heparin every 4 hours; and (c) 1 large administration of 300 mg. in 1,000 cc. 5 percent dextrose daily in normal saline at 25 drops a minute.

The clotting time was kept as close to 20 minutes as possible, but went as high as 42 and to 50 on two separate occasions. The patient experienced no ill effects at any time. His temperature was 100.5° F. on the fourth and fifth day, but subsided over night. Heparinization was not stopped. No apparent cause was found for this temperature rise.

On the third day the patient voluntarily reported improvement of vision in right eye. He stated that playing cards could be identified and that people's features were now clear enough to identify individuals. VOD was 20/70.

The heparin therapy was stopped on 9 April 1946, after 9 days of treatment. The patient was sent back for a trial of duty and returns once a week for observation. Vision on discharge was VOD 20/200, but patient stated that vision was more distinct.

The patient returned on 29 April 1946 and examination revealed definite improvement in the retina with absorption of some of the peripheral hemorrhage and less evidence of edema. VOD was 20/200 in periphery and 20/300 centrally. He states he has no associated symptoms of headache or pain in the eye and feels vision has improved subjectively. Reexamination 5 weeks after treatment revealed additional absorption in the periphery of the retina, one or two recent small central hemorrhages, persistence of papilledema. The peripheral vision was improved subjectively, the central vision was still 20/300.

COMMENT

In our review of this case, we found that the best subjective improvement took place after the continuous round-the-clock method, in which the patient received 600 mg. of heparin in a 24-hour period. We believe that this method should be investigated further.

The clotting time was taken 1½ to 2½ hours after cessation of treatment in the intermittent method of administration and every 4 hours during the period of continuous treatment. We found that the clotting time returned to normal in 3 to 4 hours on each occasion after heparin was discontinued.

The intraocular tension did not rise above 10 (Schiotz) during the patient's stay in the hospital.

The average daily amount of heparin given over the 9-day period was 400 mg.



SIMPLE DISLOCATION OF THE TALUS WITHOUT FRACTURE

Report of a Case

LANDES H. BELL

Commander (MC) U. S. N.

DISLOCATION at the talonavicular and subtalar joints is a rare injury (1). The incidence of all dislocations at the ankle (exact joint not stated) reported in the Navy for the calendar year 1943 is only 3 per 100,000 (2). Hauser (3) states that "dislocation or subluxation may occur at the calcaneocuboid and talonavicular articulations, so-called tarsal dislocations. These are rare

and usually associated with fractures of the bones of the foot." He also describes a combined talonavicular and subtalar dislocation with the head of the talus displaced medially, while in the case reported here it was displaced laterally.

This case is reported because of the rarity of the lesion, and the fact that reduction is simple if performed immediately but apparently difficult if delayed (1).

CASE REPORT

A 19-year-old aviation machinist's mate, third class, was playing soft ball when he slid for a base with the injured extremity uppermost. His foot caught on the solidly planted foot of the third baseman, and was forced into adduction and plantar flexion, which would be expected to have resulted in a simple ankle sprain. Deformity, pain, and three small skin abrasions over the protrusion on dorsum were immediately noted. The



Figure 1.—The rather impressive deformity, showing posterior dislocation at the subtalar joint, and the protrusion of the head of the talus on the dorsum.

history was negative for previous dislocation of any joint.

On admission the foot was held in marked equinovarus position and no motion was possible. The head of the talus was palpable subcutaneously on the lateral



Figure 2.—Oblique view showing lateral dislocation of talar head from its navicular bed.

half of the dorsum. The forefoot was held in adduction, and the calcaneus was more prominent posteriorly than on the uninjured side (fig. 1). The remainder of the physical examination was essentially negative.

An oblique film of the tarsal area (fig. 2) showed a lateral dislocation of the head of the talus from its articulation with the navicular. The lateral view (fig. 3) showed a posterior displacement of the entire foot at the subtalar joint, a distance of 1.5 cm., and again showed the talonavicular dislocation.

The patient was placed in position on the orthopedic table, pentothal sodium anesthesia was given, and the dislocation readily reduced by the method diagrammed (fig. 4), which consisted essentially of increased plantar flexion to farther open the talonavicular joint space, abduction of the foot and then bringing the foot to an angle of 90° with the leg, for fixation in plaster of paris (sugar tongs).

Because of the magnitude of the ligamentous and possibly cartilaginous injury, the plaster molds were removed on the tenth day and roentgenograms made again to be certain that no fracture was present (fig. 5). He was put up in a walking caliper for 4 additional weeks. One week after removal of the walker, dorsiflexion and plantar flexion were returning well; there was about 5° of eversion; inversion at the subtalar joint could be accomplished, and walking with a good gait was painless. The man was then transferred to a separation center and could not be followed further, so the possibility of a delayed subtalar traumatic arthritis cannot be ruled out.



Figure 3.—Lateral view showing 1.5 cm. posterior dislocation of foot at subtalar joint.

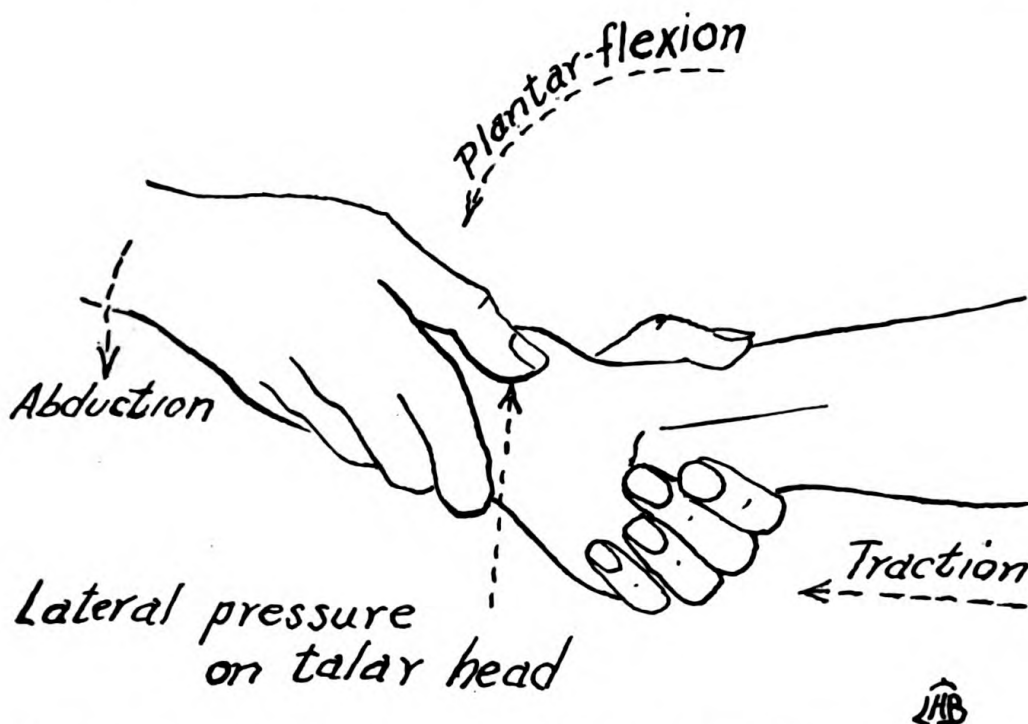


Figure 4.—Mechanism of reduction with counter traction to flexed knee to relax G-S group.



Figure 5.—Lateral view showing reposition of talonavicular and subtalar dislocations, and absence of demonstrable fracture.

REFERENCES

1. KEY, J. A., and CONWELL, H. E.: *The Management of Fractures, Dislocations, and Sprain*. 3d edition. The C. V. Mosby Company, St. Louis, Mo., 1942. p. 1249.
2. Report of the Surgeon General "Medical Statistics" U. S. Navy, Calendar year 1943.
3. HAUSER, E. D. W.: *Diseases of the Foot*. W. B. Saunders Co., Philadelphia, Pa., 1940. p. 282.



LONGEVITY IN THE UNITED STATES IN 1946

The expectation of life today, based on 1946 death rates, has reached a new high of nearly 67 years. The expectation of life at birth, for white females, is 70.3 years; exceeding the biblical "three score and ten" for the first time in the history of this Nation. The average length of life for white men is 65.1 years. For nonwhites the figures are 61.0 years for females and 57.5 for males.¹

In Europe during the sixteenth century the average length of life was 18 years; at the close of the eighteenth century it was less than 25 years. In the United States the average length of life² was 33 years in 1800; 39.77 in 1855; in 1901 it was 49.24; and in 1920, 56.32.

¹ NATIONAL OFFICE OF VITAL STATISTICS, PUBLIC HEALTH SERVICE, Washington, D. C.: Longevity in United States sets new mark in 1946. Advance Release, July 26, 1948.

² VEDDER, E. B.: *Medicine; Its Contribution to Civilization*. Williams & Wilkins Co., Baltimore, Md., 1929, p. 279.

PREVENTIVE MEDICINE

Captain Robert W. Babione, Medical Corps, United States Navy, in Charge



VENEREAL DISEASE CONTROL BY PUNISHMENT

ROBERT W. BABIONE
Captain (MC) U. S. N.

There is currently a trend toward advocating the restoration of such punitive measures as deprivation of liberty ashore for the purpose of forcing the VD-prone individual to be more careful in his exposure. While the thought of employing force is tempting because of its ease of employment, and while it seems to some that one who acquires a venereal disease should be punished and that this is the only effective appeal to those individuals who carelessly expose themselves to venereal disease, it is well to look at the record. Does punishment reduce the amount of venereal disease in a command or does it merely lead to concealment or self-treatment or by treatment by other than official sources?

In the light of past and current experience it appears that such punitive measures certainly produce both results.

It is believed that the reduction of venereal disease rates accomplished by punitive restriction of liberty is largely only a paper reduction. This is based on the observation that the rates for gonorrhea are reduced, but not those for syphilis. Since January 1947, the Army has tried 30- 60- 90-day "working quarantine," i. e., deprivation of liberty for 30 days for the first venereal infection, 60 for the second, and 90 for the third. The Army rates dropped, but the ratio of gonorrhea cases to syphilis dropped at the same time to ratios of from 2:1 to 6:1 in contrast to former ratios of well over 10:1.

Naval experience corroborates this. In one naval district, one naval area, and one continental naval station, the Army regulations were applied. The result to date is shown in table 1.

It is to be noted that there was a reduction in gonorrhea after restrictions were applied but no reduction or else an increase in the number of cases of syphilis.

TABLE 1

	Cases of syphilis	Cases of gonorrhea	Ratio
Noncontinental naval district:			
(1) 6 months just prior to regulation.....	8	158	1:20
(2) First 6 months after.....	7	140	1:20
(3) Next 6 months after.....	11	79	1: 7
Noncontinental naval area:			
(1) 6 months just prior to regulation.....	13	250	1:19
(2) First 6 months after.....	21	140	1: 6.7
(3) Next 8 months after.....	21	114	1: 5.4
Continental naval station:			
(1) 6 months before.....	4	50	1:12.5
(2) First 6 months after.....	3	58	1:19
(3) Next 8 months after.....	12	46	1: 4

NOTE.—Population did not change materially in the above periods.

For the purpose of determining the factors behind the reduction in VD rates following application of restriction, the above is only indirect evidence, but it suggests that concealment is by far the most important factor. This is just what one would expect. The man who contracts gonorrhea and to whom \$10 or \$15 is a small price to pay for 30, 60, or 90 days of freedom will find some way of obtaining unofficial treatment. He cannot be cured of syphilis so easily or cheaply.

Self-treatment or unofficial treatment has been employed frequently in the past during the era of punitive measures and indubitably is and will be employed again wherever they are restored. The magnitude of unofficial treatment can be directly estimated from the altered ratio of gonorrhea to syphilis, unless a radical change in prophylaxis habits occurs. It is conceivable that an increased use of the condom without other prophylaxis might reduce the attack rate of gonorrhea more than that of syphilis, but only to the extent that the cases of syphilis show a primary lesion outside the area protected by the condom. Evidence that fear of restriction leads to an increased use of condoms on the part of those not deterred from exposure is desired.

Until some such evidence is forthcoming it is believed entirely correct to say that punitive restriction of liberty has not significantly reduced the actual amount of VD in any command because where a reduction has occurred, it is observed to be in the diagnosed cases of gonorrhea only, not those of syphilis.



PULMONARY TUBERCULOSIS

Experiences in a Naval Hospital

J. A. C. GRAY

Commander (MC) U. S. N.

During the year of 1947, the diagnosis of pulmonary tuberculosis in some form had been established in 62 cases at the U. S. Naval Hospital, Portsmouth, Va. In a recent review of this material, the observations seemed to be of sufficient general interest to warrant their presentation. A brief survey rather than a detailed clinical description is intended.

It might be assumed that the patients in a naval hospital would differ in some respects from those in a civilian hospital or clinic, for, while the tubercle bacillus is everywhere the same, the "soil" might be expected to be different. Naval personnel are selected originally, and are subject to annual x-ray and photofluoroscopic examination of the chest. Furthermore, naval personnel have but to ask for an examination and, barring unusual circumstances, it is done. Yet to our surprise our figures show that on the average the disease was more advanced in our patients than in those found in the 40,283 examinations conducted by Schiller (1) at the Buffalo Recruiting and Induction Station during the war. It was more advanced than in those reported by Wayburn (2) in the 77,000 United States Army Air Force personnel in England in 1945. It was only slightly better than the average stage of the disease found by Trenchard (3) in a survey of 250,000 Royal Air Force personnel in England in wartime. As Bogen and Strickland (4) pointed out in their review of tuberculosis at a tropical naval hospital, "the disease was usually recognized much too late in these men."

While the total number of our cases was not great, and constituted only about 0.5 percent of hospital admissions, it is evident that current procedures have not eliminated serious clinical tuberculosis from the Navy.

Our 62 patients ranged in age from 17 to 42 years. Most were young men in the early twenties. Fifty-four men were white, 5 were Negroes, and 3 were Filipinos. All rates and ranks from seamen, second class, to commander were involved. It is of interest that 50 patients were discovered by routine roentgenograms and 12 because they had sought medical advice and physical examination.

A set diagnostic procedure is followed. When tuberculosis is suspected, in addition to the history and physical examination, roentgenograms are made, a tuberculin test is done (using purified protein derivative), and a sedimentation rate determined. Careful note is made of the temperature. If obtainable, a specimen of the sputum is

sent to the laboratory daily for 5 days. Otherwise, or if 5 specimens are negative for tubercle bacilli, recourse is had to gastric washings. A culture is made from these when indicated. If this program is inconclusive, a delay of at least 1 month is necessary in order that serial roentgenograms may be made and that other conditions, such as fungus disease or tumor, might be eliminated. If at the end of a reasonable time the roentgenogram remained suspicious but no confirmatory data were obtained, the roentgenologist and other interested parties approached the case from the point of view of this simple question: "If this were your chest roentgenograms, what would you want to do?" If the answer is, "I would want to take treatment for tuberculosis," the diagnosis is established and disposition planned accordingly.

Our cases fell into 5 diagnostic groups, as defined by the National Tuberculosis Association (5): (a) Tuberculosis, Pulmonary, Primary, Active; (b) Tuberculosis, Pulmonary, Reinfection, Arrested Minimal, or (c) Active Minimal; (d) Moderately Advanced Active Tuberculosis; and (e) Far Advanced Active Tuberculosis. A brief description of each group will be presented.

(a) *Tuberculosis, Pulmonary, Primary, Active.*—One 19-year-old white youth was thus classified. The diagnosis was based on lack of evidence of previous infection, strongly positive tuberculin test, roentgenogram findings, and persistent asthenia. He was observed for 64 days before the diagnosis was established.

(b) *Tuberculosis, Pulmonary, Reinfection, Arrested, Minimal.*—There were six patients in this group. None of them felt ill, but on questioning three admitted weight loss and productive cough with possible fever. Physical examinations were negative in all cases and none were febrile. All had negative sputa or gastric washings. The tuberculin test was positive where recorded. The sedimentation rates were normal. Despite our inability to prove activity over an average observation period of 51.5 days, the roentgenogram findings were considered to be "clinically significant" and the patients were either separated from the service or definitive treatment was planned.

(c) *Tuberculosis, Pulmonary, Reinfection, Active, Minimal.*—Nineteen cases (30.7 percent) fell into this classification. Diagnostically, this group presented the greatest problem. While the roentgenogram was usually convincing, collateral evidence was likely to be difficult to find. Among these patients, only 1 had consulted a physician of his own accord. In only 6 were we able to elicit symptoms on questioning. On the other hand, physical examination showed signs of disease in 10 patients, and fever was present in 12. The tuberculin test was regularly positive. The sedimentation rate was elevated in 7. Positive sputum was obtained in all but 1 case and positive gastric washings in all but 2. The average observation period was 42.8 days.

In establishing the diagnosis, we often were guided by the nature of the roentgenogram alone. Our criteria were essentially the same as those outlined by Reisner and Downes (6) in their New York City Health Department material. Where available, confirmatory data were of course valuable.

(d) *Tuberculosis, Pulmonary, Reinfection, Active, Moderately Advanced.*—One would expect the minimal cases previously described to comprise the majority of naval cases of tuberculosis. The fact was, however, that they constituted only 41.9 percent of the total. There were 26 cases of moderately advanced tuberculosis, or as many as the minimal cases, active and arrested combined. Ten patients sought treatment because they felt sick. Twenty patients proved to be symptomatic on questioning. Sixteen patients presented physical signs, and 17 were febrile. The tuberculin test was regularly positive. Sixteen patients had positive sputa or gastric washings. The sedimentation rate was elevated in 15 cases. The average observation period required to establish a diagnosis was 16.4 days.

(e) *Tuberculosis, Pulmonary, Reinfection, Active, Far Advanced.*—There were 10 patients (16.1 percent of the total) who had far advanced tuberculosis. Of these, eight were found by routine radiography. Two denied any symptoms. Physical findings were present in eight and eight were febrile. One patient had a negative tuberculin test, probably due to anergy. Positive sputum was easily obtained in eight cases, and the sedimentation rate was elevated in seven. It required an average observation period of 11.3 days to establish the diagnosis.

In seeking for reasons for the delay in recognition of these far advanced cases, various explanations were found. Two men, each with many years of service, had never had a chest roentgenogram, probably due to the exigencies of the service in wartime. Neither one was surprised when told that he had tuberculosis, for both admitted prolonged, productive cough. In three cases attacks of pleurisy were either ignored or not followed up. One patient gave a history of frequent colds, the significance of which was not recognized.

COMMENT

Tuberculosis, serious for the patient and for the public-health, does exist in the Navy today. There are several reasons for this. In some instances, the patients bring the disease into the service with them. For example, a 17-year-old marine began to cough and feel ill during his training period. His symptoms began so soon after his enlistment that there can be little doubt that the disease must have existed prior to the enlistment. Then, naval personnel do not lead sheltered lives. Three of the patients probably became infected while

serving in hygienically depressed areas of the world: one in China, one in postwar Germany, and one in rural Panama. Tuberculosis may be venereal in origin at times, as illustrated by one of our cases. Another factor is the crowding inherent in life aboard ship. We received four patients from one ship within a period of 2 months. Epidemiologically, it is likely that the first case infected two of the others, for there was close occupational contact between them for 2 months before the disease was recognized in the original case. Despite all efforts at screening, the disease is bound to turn up.

Leaving out the 6 cases regarded as arrested, we had 56 cases of active tuberculosis. Of these, only 12 had sought medical advice previously. Many of the others did not feel sick, but there were entirely too many who had cough, fever, night sweats, loss of weight, and asthenia, alone or in combination, who did nothing about it.

The physicians bear a share of the responsibility. Many appear to have a relatively low "index of suspicion" regarding tuberculosis. In the Navy this may be so because medical officers rely heavily on routine roentgenography for case finding. While there is no argument that the roentgenogram is far superior to physical examination in the detection of early cases, the physician cannot allow his thinking to become mechanized. Tuberculosis remains endemic, and it is a menace which cannot be ignored by the practitioner.

A few remarks about diagnostic procedures are appropriate. We have found, as did Bogen and Strickland (4), that the value of the tuberculin test has been underrated in recent years. It is useful both for elimination and for diagnosis. A considerable percentage of young people today are tuberculin negative. Hence the reaction, positive or negative, has a definite significance. Where positive, the severity of the reaction has paralleled the clinical severity of the disease in our cases. It is no longer true, as many of us were taught in medical school, that a positive tuberculin test in an adult is routine and therefore meaningless.

In the matter of sputum examinations, it is the writer's conclusion that in minimal cases the study of ordinary stained smears is almost a waste of time. Often patients are unable to raise bronchial secretions, and a cup containing saliva reaches the laboratory. Even if a satisfactory specimen is obtained, many long and time-consuming searches must be made, and even if these are repeatedly negative nothing has been proved. In our experience, smear of the gastric washings has been little better in these cases. Therefore we plan, in the future, to abandon the ordinary sputum examination, unless copious sputum is available, and to have cultures made from the gastric washings from the start. The chief of the laboratory concurs in the belief that this will not only be more efficient but will save time in his department.

SUMMARY

1. A brief review of 62 cases of pulmonary tuberculosis diagnosed in 1 year in a naval hospital is presented.

2. That over one-half of the patients suffered from moderately or far advanced disease is emphasized.

3. Attention is called to the fact that physicians and laity are in danger of being lulled into a false sense of security by routine mass radiography.

REFERENCES

1. SCHILLER, I. A.: Chest photoroentgenography in Army physical examinations; review of 40,283 chest photoroentgenograms at Buffalo Recruiting and Induction Station. *Am. Rev. Tuberc.* 53: 103-114, Feb. 1946.
2. WAYBURN, E.: Mass miniature radiography; survey in United States Army Air Forces. *Am. Rev. Tuberc.* 54: 527-540, Dec. 1946.
3. TRENCHARD, H. J.: Symptoms of early pulmonary tuberculosis. *Lancet* 2: 842-843, Dec. 29, 1945.
4. BOGEN, E., and STRICKLAND, G. H.: Tuberculosis in tropical naval hospital. *Am. Rev. Tuberc.* 52: 490-494, Dec. 1945.
5. National Tuberculosis Association: Diagnostic Standards and Classification of Tuberculosis. Nat. Tuberc. Assoc., New York, 1940.
6. REISNER, D., and DOWNES, J.: Minimal tuberculous lesions of lung; their clinical significance. *Am. Rev. Tuberc.* 51: 393-412, May 1945.

THE HEALTH SERVICES PROGRAM IN THE TRUST
TERRITORY OF THE PACIFIC ISLANDS

FREDERICK C. GREAVES

Captain (MC) U. S. N.

The Trust Territory of the Pacific Islands is the present designation of the former Japanese Mandated Islands of Micronesia and includes 2,133 islands, atolls, and reefs in the Marshall, Caroline, and Marianas groups (fig. 1). This collection of small land masses is scattered over approximately 2,000,000 square miles of the Central and Western Pacific, an area two-thirds the size of the continental United States. It lies west of the 180th Meridian and north of the equator. The distance between the easternmost islands in the Marshalls and the westernmost in the Carolines is 2,600 statute miles. The southernmost island, Kapingamarangi, is located 65 miles north of the equator, and Farallon de Pajaros, the northernmost, is at 21° North Latitude.

American jurisdiction was established during the war when the area was taken from the Japanese and placed under the Military Government organization. This continued into the postwar period and was terminated by Executive Order on 18 July 1947 when the Trusteeship Agreement was concluded between the United States Government and the Security Council of the United Nations. In terminating the Military Government, the President directed the Secretary of the Navy to assume administrative responsibilities pending the enactment of suitable legislation by Congress establishing the permanent governing authority.

This report is concerned with problems connected with health and sanitation. There are approximately 50,000 native inhabitants who live in about 120 isolated island communities. They may be classified as a primitive race who, before the arrival of the white man from Europe and America and the yellow man from Asia, had had no contact with the infectious disease of civilization and hence no racial immunity against them. They have paid dearly for their associations with foreigners in the past. Their population a century and a half ago was three times what it is today and the loss can be attributed directly to their contacts with the outside world. Epidemics of infectious disease played a major role. Typhoid fever, smallpox, and measles were particularly virulent and exacted heavy tolls in life among persons of all ages. The other exanthematous and infectious diseases were deadly among the children with reports that in many places only one child out of four survived his second birthday. Birth rates dropped. The Japanese reported that 50 percent of the marriages at Yap and between 20 percent and 30 percent in the Palaus were sterile. The reasons for this were never determined, but it is known that the venereal disease rates in the Palaus are extremely high and may be an important factor. Those islands which fell under the domination of Spain experienced wars of extermination and various governmental tyrannies which depleted the populations. The health of the natives received little consideration until the beginning of the twentieth century. Germany exercised control over the area for 15 years following the Spanish-American War and made some progress in the improvement of sanitation. The Japanese who followed made an excellent start during the first 15 years of their tenure. They built seven hospitals throughout the mandated area, primarily for the care of Japanese immigrants, but services were provided for the natives on a fee basis when they could afford to pay for them. Measures were taken by Japan to introduce modern sanitation and at Yap a sincere effort was made to reverse the depopulation trend caused by tuberculosis. The Japanese were too busy with other matters after 1937 to give serious consideration to public health and when war came

it proved disastrous for the natives. Islands where the Japanese established military bases became the targets of bombers, naval gunfire, and landing operations. Native life was disrupted and, while a relatively few natives were killed or wounded, their villages were reduced to shambles and their means of livelihood destroyed. The population which lived in close contact with Japanese garrison forces became heavily seeded with tuberculosis and the venereal diseases.

Their unhappy experiences of the past have had very little effect upon their racial docility and friendliness. In common with all primitive people they are conservative about adopting new ideas, particularly when they are at variance with their native habits and customs. They are blessed with a high degree of intelligence which affords the mental equipment for education, not only on the grade-school level but on that of higher education as well. They are quick to accept the elements of civilization that benefit them, interest them, or amuse them. They accept medical care for their ailments without question because they have learned that this is of benefit to them.



—Official U. S. Navy Photo.

Figure 2.—A group of native children at Ujelang, Marshall Islands. The inhabitants of this atoll originally lived at Eniwetok and were moved to Ujelang in December 1947.

The Trusteeship Agreement which directed the administering nation, the United States, "to care for and improve the health of the inhabitants," in effect imposed no new obligation upon the Medical Corps. Medical care had been extended to the natives living near military establishments during the war and attention had been given to the sanitation of their villages as a part of the program to protect the health of military personnel. These practices carried over into the postwar period under Military Government and were extended to include all the islands within the limits of available resources. The situation created by the Trusteeship Agreement, however, emphasized the need for a definite long-range policy.

Two courses of action were open for consideration. The first was to recognize the inhabitants as a primitive people who were satisfied to be left undisturbed in their native ways of life and to limit all actions in the fields of health and sanitation to that required in protecting the health of American administrators living in their communities. Such a course would be simple and economical and would follow the precedents set by our Spanish, German, and Japanese predecessors. It had the advantage of avoiding the encouragement of an attitude of dependence among the natives, but it would accomplish little in improving the health of the people, lowering infant mortality rates, or building up the population to levels that existed before the coming of the foreigners. The second alternative was to interpret the challenge of the Trusteeship Agreement literally and to proceed upon a course of action that would be based upon accepted American standards.

The second alternative was selected. The program adopted was based upon the establishment of the goals to be attained and upon the employment of native leadership in overcoming the conservatism about modern ideas of health and sanitation. It was recognized that the most important phases of the program were medical and dental care for all the inhabitants and a public health organization that would raise the standards of sanitation and control communicable diseases. It was realized that this would require a large group of trained personnel which it would not be practicable to furnish from those serving in the medical department of the Navy. It was decided, therefore, to train selected native men and women for many of these duties and after training them to enroll them as paid employees of the Civil Administration for services among their own people, preferably on their native islands, where they will be able to carry out routine duties under the supervision of a few key medical department personnel strategically located at the various Civil Administration headquarters. This plan will relieve the medical department of a personnel problem and, in addition, it will place a considerable por-

tion of the health program in the hands of the inhabitants who will administer to most of the needs of their people and serve as leaders in overcoming the native reluctance toward giving up age-old habits; it will promote native participation in and control of the Health Services which is in consonance with the stated policies of the Trusteeship Agreement and the United States Government. It will avoid a hiatus in a functioning service should a civilian agency be required to relieve the Navy of the responsibilities, and it will provide such an agency with the nucleus of a functioning organization.

It was felt that consideration should be given to the subject of medical research. There are several conditions known to exist in the islands that warrant intensive study, not only in the interest of the inhabitants but for their value to the medical profession as a whole. At the present time an unidentified strain of encephalitis virus is present among the natives of Ponape. It apparently has been present on the island for many years. The severity of its symptoms and its relationship to seasons of the year are variable and the transmitting agents or vectors have never been determined. There are other problems, and as time goes on new ones will be discovered. The program adopted recognized the importance of research and established procedures for carrying out such studies when personnel and facilities became available.

The program was promulgated by the High Commissioner on 5 August 1947 as the Health Services Policy for the Trust Territory of the Pacific Islands and is given below :

**THE PACIFIC COMMAND
AND UNITED STATES PACIFIC FLEET**

Headquarters of the Commander in Chief

5 August 1947.

**THE HEALTH SERVICES POLICY FOR THE TRUST TERRITORY OF THE
PACIFIC ISLANDS**

I. MISSION

1. To raise public health standards in the Trust Territory of the Pacific Islands and to control preventable disease among the inhabitants thereof.
2. To provide the means of rendering medical and dental care to the inhabitants of the Trust Territory of the Pacific Islands.
3. To conduct medical and dental research into public health problems peculiar to the Trust Territory of the Pacific Islands and their inhabitants.
4. To train native men and women in the arts of medical, dental, and nursing practice.

II. PREVENTIVE MEDICINE PROGRAM

1. An annual health and sanitary survey shall be conducted on each inhabited island.

2. Provisions shall be made for the reporting of preventable diseases and the collection of appropriate vital statistics.

3. A program for the eradication of intestinal parasites and yaws shall be placed in operation.

4. An organization for the treatment of tuberculosis and leprosy shall be established.

5. A program to insure potable water and the sanitary disposal of sewage and garbage shall be established.

6. The immunization of natives against smallpox, typhoid fever, and tetanus shall be routine.

7. An efficient program for the control of rodents and other pests shall be established.

8. Quarantine rules and regulations shall be promulgated to prevent the importation of preventable diseases into the islands and between the separate islands.

9. A practical food sanitation program shall be adopted.

10. A program to improve the nutritional status of the inhabitants shall be established.

11. A venereal disease program shall be maintained.

III. MEDICAL AND DENTAL CARE PROGRAM

Hospital, dispensary and out-patient medical and dental care shall be provided for the inhabitants of the Trust Territory of the Pacific Islands. A progressively self-sustaining status for these services shall be encouraged. A procedure for licensure of private practitioners in medicine, dentistry, and nursing shall be promulgated.

IV. RESEARCH PROGRAM

1. A medical and dental research program shall be established. It shall embody the procedures for submission of requests and recommendations for research projects and for their consideration by a board of qualified officers appointed for that purpose.

2. Periodic and final reports of all medical and dental research projects shall be submitted, via official channels, to the Bureau of Medicine and Surgery.

V. NATIVE TRAINING PROGRAM

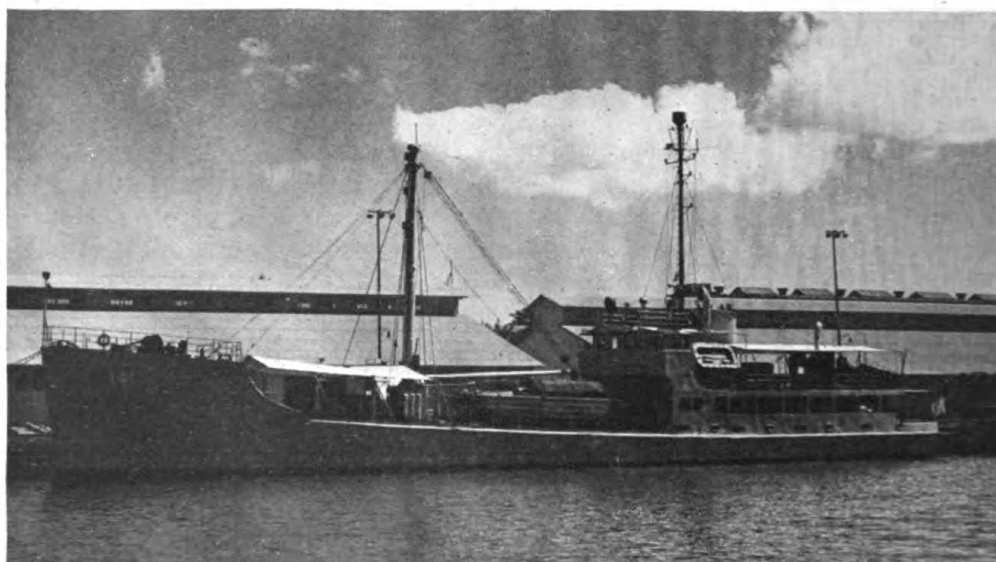
A training program for native men and women in the arts of medical, dental, and nursing practice shall be maintained to provide a sufficient number of trained individuals to meet the needs of the inhabited islands. Candidates for training shall be carefully chosen for intelligence, leadership, character, good health and such other qualities as may be prescribed, from time to time.

VI. This program shall be considered as the Health Services Policy of the United States Navy for the Trust Territory of the Pacific Islands. Its realization will be dependent upon personnel, funds and other facilities available. Every effort shall be made to reach the goals set at the earliest practicable time.

(S) Louis Denfeld,
LOUIS DENFELD,
Admiral, U. S. Navy,
High Commissioner,
Trust Territory of the Pacific Islands.

Accurate knowledge of the problems involved is fundamental to the successful execution of a program of this nature. There is reason to

believe that tuberculosis is distributed widely throughout the Trust Territory and that it is the leading cause of death. Authentic data on morbidity and mortality rates are needed before an effective campaign to control the disease can be instituted. There are between 60 and 70 diagnosed cases of leprosy scattered about on various islands, with 33 at Yap alone. There are probably early undiagnosed cases in other places. Intestinal parasitism is probably universal but exact information on types of infestation is lacking. Very little is known about the public health practices on the remote outlying islands. These are matters of vital importance. Some information is available but it is incomplete and based solely upon routine observations. That which has been obtained by Civil Administration dispensaries for their immediate vicinities is accurate, but often incomplete. Medical personnel from these dispensaries make field trips to the outlying islands in their districts at intervals of about 2 months, but transportation schedules rarely permit more than a few hours in each community. This allows for little more than a general inspection of the inhabitants with treatment of the more seriously ill. Information collected under these conditions has little statistical value.



—Official U. S. Navy Photo.

Figure 3.—U. S. S. WHIDBEY, medical survey ship, now conducting a health and sanitation survey of the Trust Territory.

A health and sanitation survey of the inhabited islands has been undertaken. U. S. S. *Whidbey*, a 177-foot vessel, has been converted into a medical survey ship (fig. 3) and assigned the mission of obtaining authentic data on the state of health and incidence of disease among the natives and the status of public health practices on the

inhabited islands. The ship is equipped with a clinical laboratory, a photofluorographic unit, facilities for complete physical examination, and a dental examination department. The medical complement consists of 2 medical officers, one of whom is a qualified clinical pathologist, the other a roentgenologist, 1 dental officer, 1 medical service corps officer qualified in epidemiology and public health, and 10 hospital corpsmen with technical ratings in clinical laboratory, x-ray, dentistry, epidemiology, and clerical procedures.

The ship is operating on a schedule which permits it to visit each inhabited island and remain long enough to conduct physical and dental examinations on every inhabitant, including chest photofluorography, tuberculin skin tests, blood Kahn tests, stool examinations, and such other laboratory work as is indicated. These examinations are being conducted on board ship. The members of the sanitation crew, meanwhile, are carrying on an investigation of the sanitation ashore. They evaluate the merits, or lack of them, of water supplies, food supplies, sewage and garbage disposal, control of communicable diseases, insect and other pest control, housing, obstetrical practices, care of the dead, and they collect information on local customs which have a direct bearing on modern public health practices. Statistics thus assembled are coordinated into a report which is submitted upon completion of the work on each island. Data collected in this manner will afford an opportunity to base definitive action in the various fields of the health program upon information that is authentic.

The organization for medical and dental care is built around the Civil administration dispensaries which are located at the various District Headquarters, Kwajalein, Majuro, Ponape, Truk, Koror, and Saipan. These are capable of furnishing routine medical and surgical care for a limited number of persons. The bed capacities, medical department personnel attached and native populations served are shown in table 1. Medical Department functions on the outlying islands are carried on by native health aids (fig. 4). These are selected men who have been given instruction of a few months duration in first-



—Official U. S. Navy Photo.

Figure 4.—Ujelang, Marshall Islands.
Health aid examining a native child in the island dispensary.

aid procedures and the fundamentals of sanitation at the District dispensaries. They are serving in an interim status and will be replaced eventually by the more completely trained medical, dental, and nursing assistants as quickly as these become available. Their activities are supervised and augmented by the medical department personnel from the district dispensaries who visit their islands on field trips at which time patients requiring hospital care are picked up and returned to the district headquarters. Air and surface transportation schedules between Guam and the various district headquarters permit the transfer to the Guam Memorial Hospital of patients requiring facilities beyond the capacity of the district dispensaries. The Guam Memorial Hospital with 300 beds is maintained for the natives of Guam but its facilities have been made available to the inhabitants of the Trust Territory. It is a component part of the Guam Naval Medical Center, which also includes the United States Naval Hospital, and is an arrangement which provides extensive diagnostic and treatment facilities.

TABLE 1.—*Civil administration dispensaries*

Location	Beds	Medical officers	Dental officers	Nurses	M. S. C. officers	Hospital corpsmen	Islands/atolls served	Native population served
Kwajalein.....	25	2	1	2	1	5	14	4, 270
Majuro.....	50	2	0	0	2	5	9	5, 270
Ponape.....	25	3	1	0	1	6	7	9, 577
Truk.....	50	3	1	0	1	6	12	15, 065
Yap ¹	25	1	0	0	0	2	-----	2, 743
Koror.....	50	4	1	0	3	8	20	8, 004
Saipan.....	100	3	1	3	4	11	5	8, 548

¹ Yap originally was the Civil Administration headquarters for a district made up of 12 outlying islands and was disestablished 1 July 1948. The dispensary will be continued because of the unusually low status of health and sanitation on the island.

² Civilian dentists from the United States employed by the Civil Administration on a contract basis.

The above organization is the best that can be provided under existing conditions and is reasonably satisfactory. Lack of communications between the outlying islands and their District Headquarters, plus the limited transportation facilities, are a definite handicap. It is impossible to provide radio communication with outlying islands because of the lack of equipment and trained personnel. The result is that medical emergencies remain undiscovered until the arrival of the logistic supply ship on field trip duty. The average interval between such trips to the individual islands is 2 months. Relief lies in the provision of communication equipment, coupled with the training of native radio operators, and in a more extensive transportation system. Dental care for the natives living on outlying islands is particularly difficult to provide. It has been necessary to hire civilian

dentists to man dental billets at some district headquarters. The dental officers and dentists occasionally make field trips, but this is not particularly desirable because it leaves the district dispensary without dental care while they are gone. It has not been found practicable to train and use dental aids in the same manner that health aids are being used as an interim measure until the native assistants become available. As can be seen, personnel shortages present the major difficulties in the medical and dental care program.



—Official U. S. Navy Photo.

Figure 5.—Civil administration dispensary at Koror, Palau District, Western Carolines.

The care of the lepers has been accorded particular attention because of the dramatic potentialities involved. The natives have the same fear of the disease that is found in civilized communities and they force the lepers in their communities to live as outcasts in isolated areas (fig. 6). It has been impossible for medical department personnel attached to civil administration dispensaries to give these unfortunate people the care and treatment they require. Attempts to have them admitted to the Kalaupapa Settlement on Molokai were unsuccessful because the Territory of Hawaii objected to assuming responsibility



—Official U. S. Navy Photo.

Figure 6.—Lepers at Yap, Western Carolines. Persons afflicted with this disease are shunned by the other natives throughout the Trust Territory and forced to live as best they can in isolated areas such as this. All lepers will have been transferred to the leper colony at Tinian by the time this article is published.

for wards of the Federal Government. The distance and transportation difficulties involved in transferring them to Carville, Louisiana, rendered use of this Federal leprosarium impracticable. The remaining alternative was the establishment of a leper colony in the Trust Territory where lepers can be segregated and treated. This has been accomplished. A leper colony has been established at Gurguan Point on the island of Tinian where it can be supported logistically and professionally by Guam and Saipan. Present accommodations are sufficient to care for 100 lepers, and consist of individual cabins in which the patients can live under conditions that approximate those to which they are accustomed in their own communities. There is a dispensary where modern chemotherapy can be administered by the resident Navy medical staff and where other hospital services can be provided, as needed. The site is well chosen for segregation purposes. It is located on the beach which affords the patients an opportunity to

engage in fishing, if they so desire, and it is partially surrounded by sufficient arable land to permit gardening and agricultural activities. The buildings are temporary structures (fig. 7) and will have to be replaced eventually by more permanent ones but they are adequate for the present. The Tinian colony is a temporary establishment designed to meet the immediate problem with the facilities that are available. When the extent of the leprosy problem is revealed by the survey data definitive planning must be undertaken for an establishment of a permanent nature. The incidence of leprosy will decline under an enlightened public health regime but complete disappearance of the disease should not be expected within two or more generations.



—Official U. S. Navy Photo.

Figure 7.—A section of the newly established leper colony for the Trust Territory at Tinian, Marianas Islands.

The program for training the natives to assume an active role in the Health Services is well under way. It is a continuation and expansion of one which had its origin at Guam before the war. A few native Guamanians were given instruction and it was found that the persons so trained were an asset in facilitating relationships between the natives and the administration. The schools were reactivated shortly after the reoccupation of the island. Their curricula were modernized and the courses opened to inhabitants from Samoa, Koror, and Saipan. The Health Services Policy extended the privileges to all the islands of the Trust Territory.

Three schools currently are in operation, medicine, dentistry, and nursing, with Navy Medical, Dental and Nurse Corps officers and

hospital corpsmen serving as instructors. All are 4-year courses and are planned so that the students are indoctrinated in the fundamental sciences upon which the individual professions are based, plus training in the practical aspects which it is believed they will be able to carry out in the field. Students are selected at the District Headquarters on the basis of their aptitude for the work, their character, intelligence, and their capacities for leadership. Transportation to Guam and instruction is furnished without expense to the students, and each receives a monthly salary sufficient to cover living expenses. In return they are required to serve a period of obligated service as paid employees of the Civil Administration. The obstacles to be met and overcome are formidable. The students' knowledge of the English language is limited and their basic education leaves much to be desired. They are intelligent, however, and eager to learn. It is remarkable how quickly they acquire sufficient command of the language and apply it to their studies. As the general educational program in the islands proceeds better qualified students will be available, but at the present time it is necessary to work with the tools that are at hand.

The future will demand the solution of other problems. Mention has been made of the probable widespread distribution of tuberculosis. The proper control of this disease is one which will require considerable effort. Unfortunately, the fear which exists for leprosy is not felt for this highly infectious and killing disease, hence it is a far greater threat to the welfare of the race. No definite program has been decided upon yet and it is believed that none should be until the extent of the problem is revealed by the data acquired in the health survey. There is no information available at this time on the presence of mental disease among the inhabitants, hence no provisions have been made for the care of the insane. This is also a matter for future decision.

The medical installations serving the Health Services, including those of the Guam Memorial Hospital and the Naval Medical Center, are housed in wartime advanced base type buildings which deteriorate rapidly under tropical climatic conditions. It will be necessary to replace them in the near future. It is believed that permanent construction should be based upon an over-all plan for the entire Health Services rather than replacing existing structures on a unit-for-unit basis. A new Guam Memorial Hospital is now in the planning-and-funds-procuring stage. It would be to the advantage of the Federal Government to have this hospital serve the native inhabitants of the Trust Territory as well as those of Guam. Neither Guam nor the Trust Territory will be able to staff a hospital of this caliber from their

own population. American physicians from the Armed Services, or civilian employees of the Federal Government, will be required, and it would be more economical to have one hospital provide these services. There is one objectionable feature to this plan. Guam, being a possession of the United States and therefore outside the jurisdiction of the United Nations, is not a part of the Trust Territory. Should a civilian agency be designated to administer the latter without including Guam the Health Service would be forced to operate with its central unit in an area that would be outside its administrative jurisdiction. A decision in the matter of the administrative control is necessary before the question can be settled, but, in the meantime, it is believed that planning should include facilities for the Trust Territory in the new Guam Memorial Hospital.

If the Navy's Health Services Policy is continued, regardless of who administers the islands, hospitalization facilities in the District dispensaries may be reduced because it is believed the need for them will diminish as time goes on. The training program which is well under way now will produce an increasing number of Medical, Dental, and Nursing Assistants who will be able to meet many of the routine medical and surgical problems arising in their local communities. Fewer patients will be sent into the District dispensaries and more of these will be candidates for the services of the general hospital. The professional duties of the medical officers attached to the District dispensaries will be decreased, hence fewer will be required, and their major responsibility will be that of supervising the native assistants in the field.

The preventive medicine program will require time for complete realization because it is the one which must overcome the native habits, customs, taboos, and superstitions. All action in this field is being based upon gaining the confidence of the native leaders and accomplishing the results desired through the influence and authority they exercise. It is felt that satisfactory progress is being made. Attention is now being given to the cleanliness of the villages. The streets are clean, litter is not permitted to accumulate in the coconut groves where it formerly served as breeding places for flies, and all islands have learned the value of DDT spraying. Advantage is taken of every opportunity to impress upon the leaders the importance of safeguarding water supplies and food supplies and it is beginning to bear results in the covering of catchment cisterns and the campaigns against flies. Immunization against typhoid, smallpox, and tetanus is being completed on all islands as rapidly as possible. Pit latrines are being adopted in the more progressive communities and garbage is being disposed of by burning or by burying to increase the humus

content of the soil. The more complicated parts of the program, such as communicable disease control, recording of vital statistics, and quarantine procedures, will fall in line in good time when the organization for their accomplishment becomes available. There is a general feeling of confidence in the Health Services throughout the entire Trust Territory. The Health Aids are being accorded respect and satisfactory cooperation and are gradually conditioning the inhabitants for progressively increasing progress in the field of preventive medicine.

It is believed that the progress made by the Health Service during the first year of Trust Territory organization can be considered satisfactory. A policy has been decided upon and adopted. It is one that is realistic about the problems involved and it charts a course that eventually will meet the obligations imposed by the United Nations, and in a manner that is practicable, economical, and in accordance with American standards. An organization which is providing maximum medical and dental care, compatible with present resources, has been established and is functioning. A health and sanitation survey which will produce authentic data to serve as the basis for intelligent planning has been organized and is under way. A leprosarium where the lepers of the Trust Territory can be segregated and treated under hygienic conditions and in accordance with modern concepts has been established. A training program for native men and women which will provide a sufficient number to assume many of the duties of the Health Services has been placed upon a firm and long-range basis. And, finally, these accomplishments have been realized in an atmosphere of friendly cooperation between the naval officers serving as civil administrators and the Navy Medical Corps, on the one hand, and the native inhabitants, on the other. If the successful accomplishments of the first year are an omen of the future, it may be predicted that the health and welfare of the inhabitants of the Trust Territory of the Pacific Islands under American trusteeship is assured.



CLINICAL CASE FOR DIAGNOSIS

WILLIAM W. AYRES
Commander (MC) U. S. N.

HISTORY

A 34-year-old white woman was admitted to a naval hospital with the complaints of "tumor on the rib" and pain in the chest. The patient stated that 6 months prior to admission she had a "bout" of fever and chills which was diagnosed as pneumonia. However, roentgenograms of the chest showed no pneumonic process, but a lesion in the second rib anteriorly. The acute symptoms rapidly disappeared. Since the onset of her illness she had experienced a sharp, intermittent substernal pain which, at times, radiated to the back. This pain was aggravated by motion of the thorax, but not by deep breathing.

Physical examination revealed a well-developed and well-nourished white woman. The temperature, pulse rate, respiratory rate, and blood pressure were within normal limits. The only positive finding was slight tenderness in the lower sternum. No masses were palpable. Gynecological examination was negative.



Figure 1.—Roentgenogram of lesion of second left rib.

Roentgenograms of the chest revealed a fusiform enlargement of the anterior half of the second rib on the left. This enlargement was radiolucent and was traversed by delicate trabeculae. The overlying cortex was expanded and thinned, but was intact. The lung fields and heart were unremarkable (fig. 1). A roentgenologic bone survey showed no other lesions. An intravenous pyelogram was negative. Laboratory studies including total red cell count, total white cell count and differential, urinalysis, sedimentation rate, and total proteins were unremarkable. Serum calcium, serum phosphorus, and serum phosphatase studies were not done.

CLINICAL DISCUSSION

Inflammatory lesions can be fairly well ruled out in that the patient was afebrile, the sedimentation rate was normal, there was no leukocytosis, and there was no marked tenderness or skin changes over the lesion. Although the rib is a common site for a traumatic osteomyelitis, it is rare in hematogenous osteomyelitis. As a rule in syphilis of the bone, there is some sclerosis of bone, while here there was more of a lytic process, as shown by the roentgenograms. Also, the Kahn test was negative.

In the differential diagnosis some type of bone neoplasm involving the rib is to be considered. The lesion was probably primary in that a single bone was involved. Hypernephroma may show a solitary metastasis to bone. Against the diagnosis of metastatic hypernephroma was the presence of trabeculae within the tumor and the negative intravenous pyelograms.

The next question to be considered is whether the lesion was benign or malignant. All findings point to a benign lesion, in that there had been little change in symptomatology for 6 months, mild systemic signs and lack of changes in the overlying skin, the intact bony cortex, and no soft part involvement.

Among the benign tumors which may involve the rib are: (1) chondroma, (2) fibrous dysplasia, (3) giant cell tumor, and (4) benign bone cyst.

The most common location for chondroma is the small bones of the hands and feet. The next most common site is the rib in the region of the costochondral junction. This tumor occurs usually in the adult, has a slow growth, and produces but few symptoms initially. In fibrous dysplasia the common site is the rib. The lesion is often associated with few or no symptoms and produces a fusiform swelling in the rib. The clinical picture and roentgenological findings in fibrous dysplasia may be very similar to chondroma and diagnosis may rest on the operative and pathological findings. Giant cell tumor usually occurs in the epiphysis of the lower end of the femur and radius and the upper end of the tibia. It is only rarely found in the rib. Usually more bone destruction is seen by roentgenogram than was found in this

patient. Bone cysts generally occur in the age group below 21 years of age, the great majority of the patients being between 10 and 15 years of age. The lesion is usually in the upper shafts of the tibia, femur, and humerus. Geschickter (1) in a study of 175 typical benign bone cysts records no involvement of rib. Admittedly, flat bones may show cystic lesions, but they are usually associated with adenoma of the parathyroid gland with hyperparathyroidism. In this patient there were no changes in other bones, which fairly well rules out primary hyperparathyroidism.

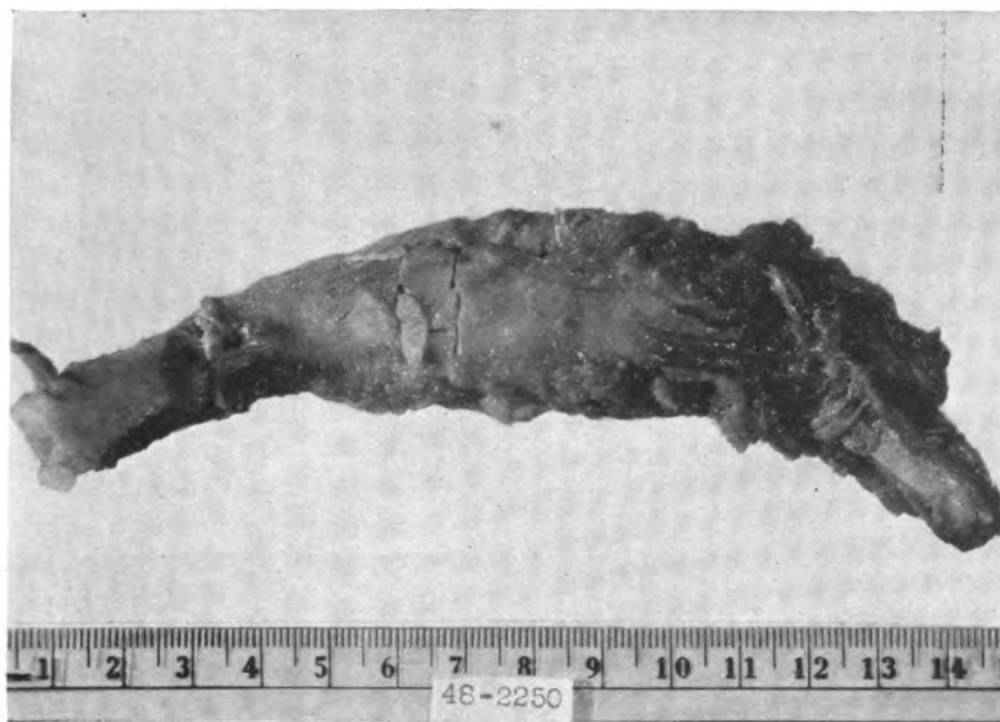


Figure 2.—*Photograph of gross specimen of rib. A window has been cut in one portion of the rib.*

The patient was presented at a tumor conference and an orthopedic consultation was obtained. It was the consensus that the lesion was probably chondroma and that an operation was indicated for microscopic verification and for ruling out malignancy. An operation was performed and the second rib resected.

Clinical diagnosis: Chondroma of rib.

Pathological diagnosis: Fibrous dysplasia of rib (monostotic fibrous dysplasia).

PATHOLOGICAL DISCUSSION

The gross specimen consisted of a fresh rib, 14 cm. in length, in the center of which was a fusiform swelling, 9 cm. in length, 3 cm. in

807235°—48—9

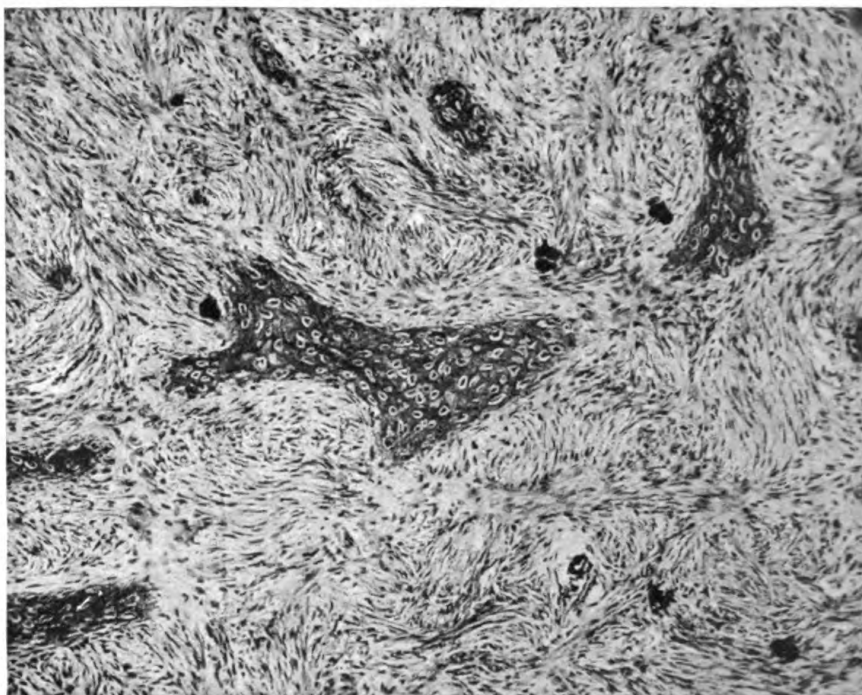


Figure 3.—Metaplasia of fibrous tissue to bone. Note the dense fibrous matrix. $\times 100$.

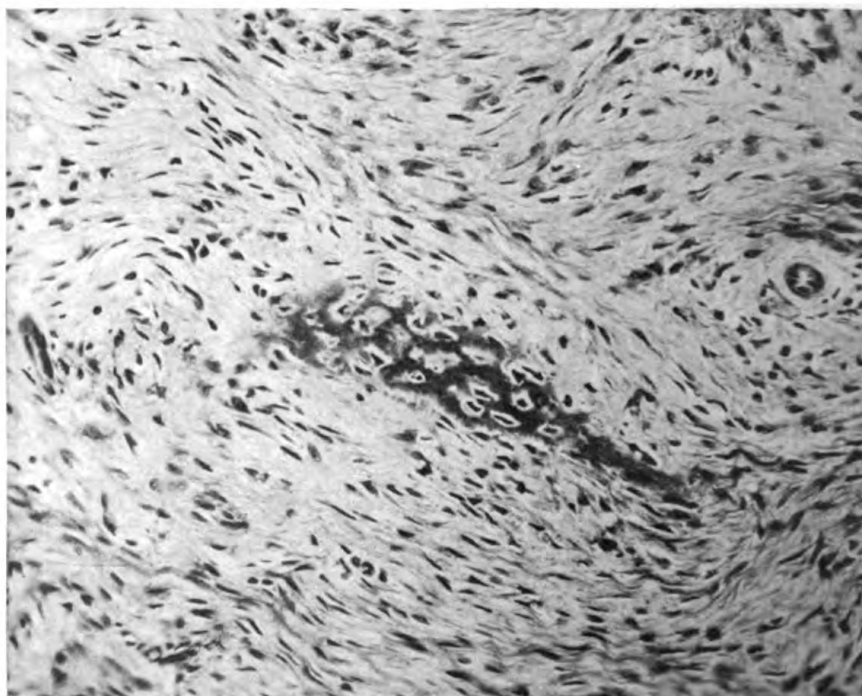


Figure 4.—Metaplastic bone. $\times 200$.

width, and 1.5 cm. in thickness. The cortex was thin, but intact. On longitudinal section the medullary cavity was replaced by firm yellow-white tissue containing many small bone spicules. There were a few small cystic spaces containing thin amber fluid. The rib adjacent to the lesion was normal as was a portion of the costal cartilage. Figure 2 shows the gross specimen. Microscopic sections showed predominately dense fibrous tissue arranged in sheets with a tendency to interlace and to form whorls. Scattered throughout this fibrous tissue were all stages of connective tissue bone formation, varying from deposition of calcium in hyalinized connective tissue to well-formed and calcified bone trabeculae surrounded by osteoblasts. The process is one of metaplasia of connective tissue to bone which may be outlined as follows: (1) Swelling, hyalinization and deep eosinophilic staining of fibrous tissue, (2) deposition of calcium in this altered fibrous tissue. The imbedded fibrocytes now have the appearance of osteocytes and the histological picture is one of new bone formation (figs. 3, 4, and 5). The multipotential fibrocytes showed swelling of their nuclei, lost their intercellular collagenous matrix, applied themselves to the newly formed bone, and appeared as osteoblasts. New bone was laid down on the margins of the bone spicules by osteoblastic activity. Also present in the section were many poorly calcified trabeculae which consisted chiefly of osteoid tissue. In some areas, especially near hemorrhage, there were numerous giant cell osteoclasts. The hemorrhage apparently was rather old although the red blood cells were intact. Some of the red cells were diffusely scattered throughout the dense fibrous tissue. The inference is that the fibrous tissue proliferation may be in response to hemorrhage. The cortex showed reactive bone in response to the proliferating fibrous tissue. No cartilage was noted. In other areas there was osteolysis of pre-existing bone spicules, associated with osteoclasts (fig. 6). The basic pathological process is one of unexplained proliferation of fibrous tissue arising in the medullary cavity of bone with the formation of bone by metaplasia of connective tissue.

Fibrous dysplasia occurring in single bones has been excellently reported by Schlumberger (2), who reviewed 67 cases of this lesion. The most common location is the rib. The symptoms are local tenderness and swelling. There may be pathological fracture if a weight-bearing bone is involved. A large number of patients with a rib lesion are asymptomatic, the lesion being discovered only on routine roentgenological examination of the chest. The treatment varies with the location; with a rib lesion, excision is indicated, while in the long bones, curettement, followed by filling in with bone chips, is the treatment of choice. In Schlumberger's patients there was no recurrence nor tendency for the lesion to progress to polyostotic fibrous

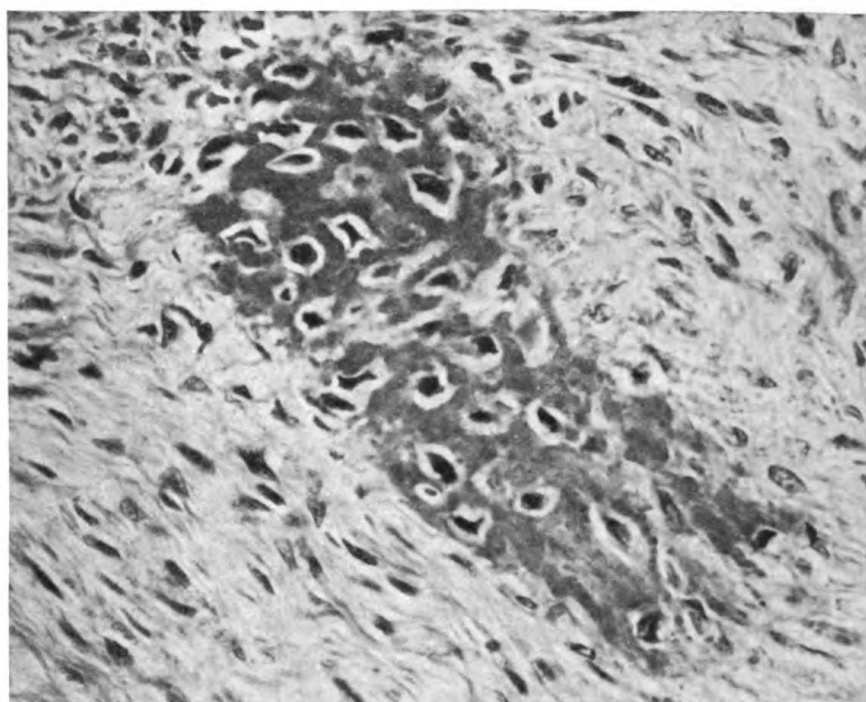


Figure 5.—Metaplastic bone. Note the gradual merging of the bone into fibrous tissue, the absence of osteoblasts. × 400.

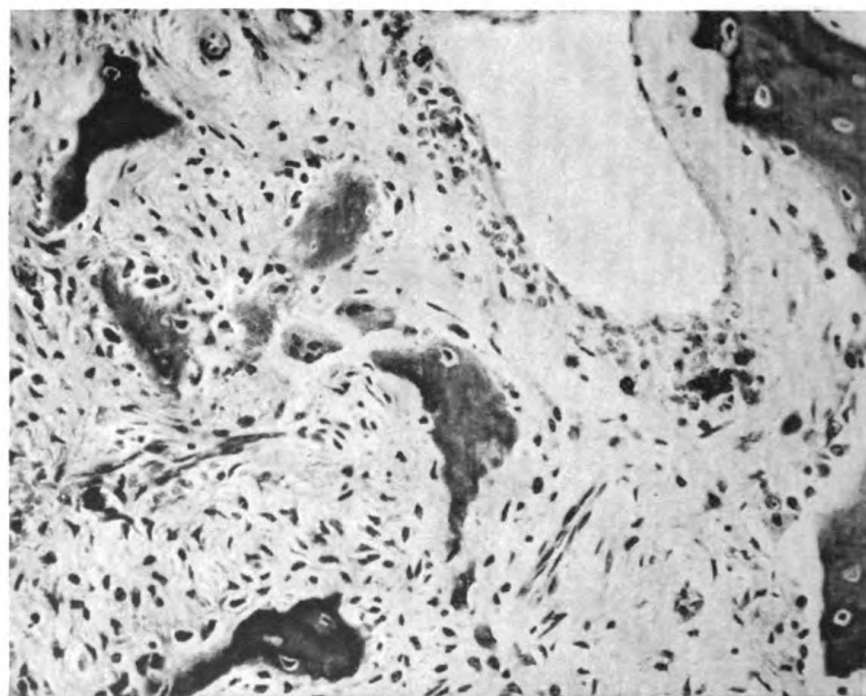


Figure 6.—Osteolysis of bony trabeculae, as indicated by the ragged into fibrous tissue, the absence of osteoblasts. × 400.

dysplasia. The appearance of the roentgenogram is not characteristic and consists of an area of radiolucency traversed by delicate trabeculae. The lesion is central in position and produces expansion and thinning of the cortex. In none of Schlumberger's cases did the roentgenologist entertain the diagnosis of fibrous dysplasia. In a few of these cases the pathologist's diagnosis was fibrosarcoma. It is to be emphasized that fibrous dysplasia should be considered in the differential diagnosis of single lesions involving bone and, in particular, if the rib is involved.

REFERENCES

1. GESCHICKTER, C. F., and COPELAND, M. M.: Tumors of Bone. 2d edition. The American Journal of Cancer, New York, N. Y., 1936. p. 246.
2. SCHLUMBERGER, H. G.: Fibrous dysplasia of single bones (monostotic fibrous dysplasia). Mil. Surgeon 99: 504-527, Nov. 1946.



THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIAL



THE CHALLENGE OF CANCER

Celsus (25 B. C. to A. D. 50) described malignant growths and referred to them as carcinode or carcinoma. He wrote that these growths were not very dangerous unless treated imprudently, but if they were excised and although healing apparently took place they recurred and death followed. He described a very early form of cancer known to the Greeks as "cacoethes" and warned that removal of these malignant growths should be attempted only in this form of cancer. He further cautioned that only the skilled could determine which "cacoethes" was amenable to treatment. The lesions described were those of the skin and superficial surfaces, and spleen. It appears that Hippocrates (460 B. C. to 377 B. C.) knew of cancer of the internal organs and that he held the disease to be incurable and incapable of being treated.

A great deal of information has been added to the knowledge regarding diagnosis and treatment since then but little has been added regarding the control, and less about the causation of cancer. Percival Pott in 1775 described the scrotal cancer of the chimney sweep which results from constant contact with soot. Rous in 1911 reported that he could reproduce the growth of chicken cell sarcoma in other fowl by injecting the cell-free filtrate of this tumor. In 1918, Yamagawa and Ichikawa reported the carcinogenic action of tar on the skin of the experimental animal.

In recent years, many interesting and illuminating contributions have been made by various investigators on carcinogenic agents; Bittner's milk factor in mammary cancer in mice; Shabad's extract of liver taken from cancer patients, which when injected into mice produces sarcoma and an increase in other tumors in mice; an extremely active carcinogenic hydrocarbon synthesized from bile acids; the structural relationship between bile acids, cholesterol and steroid

hormones. Mammary cancer is produced in some male and female rats by administering large doses of estrogenic hormones, monkeys similarly treated show no neoplastic lesions, while in the dog an hypertrophy of the prostate is the result. More than 250 carcinogenic hydrocarbons have been described. Some of these when fed to mice produce sarcoma of the intestines; if injected, they produce mammary tumors, pulmonary tumors, or leukemia. A number of simple compounds like potassium chloride or concentrated sugar solutions are capable of producing subcutaneous tumors after repeated injections into mice or rats. Several viruses, some parasites (*Bilharzia* and liver flukes), and certain forms of energy such as radium, the roentgen ray, or from ultraviolet radiation are also carcinogenic.

The development and introduction of radioactive isotopes brought with it great promise for the solution of the many problems regarding causation, control, diagnosis, and treatment of cancer. It is too early for any definite assertions regarding their practical value. There are four radioactive isotopes that seem to have specific tissue affinity: the isotope chromium phosphate for the reticuloendothelial cells, radiostrontium for bone, radiophosphorus for bone and marrow, and radioiodine for thyroid tissue. From a therapeutic standpoint, none have proved to be of greater value than high voltage roentgen therapy in the treatment of metastatic sarcoma, leukemia, and lymphoblastoma. However, there is a bright future for the isotope in many phases of medicine, as is evident by the immediate response of polycythemia vera to treatment with radiophosphorus.

The diagnosis and control and treatment of cancer still lies in the acumen of the clinician, the surgeon, and the pathologist. In order to treat this disease effectively, it is absolutely fundamental that a diagnosis of cancer be made at the earliest moment. To do this it is requisite that cancer be discovered in the symptomless patient. The well-trained and alert examiner with the assistance of the pathologist and the laboratory will accomplish this. Early and radical excision by the surgeon qualified to treat cancer is the treatment of choice. High-voltage roentgen therapy has limited uses. It is only by making an early diagnosis and then carrying out adequate surgical treatment that the patient with cancer will be cured. Otherwise, as Celsus wrote "after excision even when a scar has formed, nonetheless, the disease has returned and caused death."



OFFICERS OF THE MEDICAL DEPARTMENT

*Whose Deaths Have Been Reported Since
the Last Issue of the Bulletin*

BRUCKSHAW, HENRY ANDREW NATHANIEL, Captain (MC)
U. S. N. (Retired, Inactive). Died 7 September 1948 at
U. S. Veterans Administration Hospital, Salt Lake
City, Utah.

COOK, KENNETH DURWARD, Lieutenant Commander (MC)
U. S. N. R. (Retired, Inactive). Died 25 July 1948 at
U. S. Naval Hospital, Long Beach, Calif.

DAVEY, JAMES RUSSELL, JR., Lieutenant (MC) U. S. N. R.
(Inactive). Died 5 June 1948 at Easton, Pa.

GILMAN, PHILIP KINGSNORTH, Captain (MC) U. S. N. R.
(Retired, Inactive). Died 7 September 1948 at Stan-
ford Lane Hospital, San Francisco, Calif.

HARDIN, HAL WHITE, Lieutenant (MC) U. S. N. R. (In-
active). Died 29 December 1947 at Baylor University
Hospital, Dallas, Texas.

HIBBS, GEORGE WESLEY, Lieutenant Commander (DC)
U. S. N. R. (Inactive). Died 8 October 1947 at Win-
throp, Me.

OLEINICK, GLADYS MAE, Ensign (NC) U. S. N. Died 24
September 1948 at U. S. Naval Hospital, Great Lakes,
Ill.

URBAN, FRANK RUDOLPH, Captain (MC) U. S. N. Died
14 September 1948 at Norfolk, Va.

BOOK REVIEWS AND BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

BOOK REVIEWS

BELL'S TEXT BOOK OF PATHOLOGY, by E. T. Bell, M. D., *Professor of Pathology, University of Minnesota*. Contributions by the editor, B. J. Clawson, M. D., *Professor of Pathology*, and J. S. McCartney, M. D., *Associate Professor of Pathology, University of Minnesota, Minneapolis, Minn.* 6th edition. 910 pages with 500 engravings and 4 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1947. \$10.

The admirable features of the previous editions are retained in this sixth edition but a large part of the book has been revised. New material has been added, particularly that pertaining to vitamin deficiencies and the more common tropical diseases.

The book is a review of the general field of pathology and provides an adequate introduction to the morbid anatomy of disease processes. It is written from the medical student's point of view with the intention that it will serve as a useful adjunct during his clinical training. Although an authoritative textbook, the discussions on the various topics are too brief to be used as a reference. The subjects are presented in a logical sequence and a grasp of the fundamental concepts of pathology is readily acquired as one proceeds through the book. The chapters on tumors, particularly in regard to general discussion and etiology, are lucid, concise, and comprehensive. The section on kidney diseases is, as one would expect, excellent.

In general, the illustrations are good and the drawings are particularly descriptive. The bibliography is pertinent and well chosen. The book is conservative and is in accord with current medical opinion and is recommended as a textbook of general pathology.

AN ATLAS OF ANATOMY, by J. C. Boileau Grant, M. D., M. B., Ch. B., F. R. C. S. (Edin.), *Professor of Anatomy in the University of Toronto*. 2d edition. 546 pages; 591 plates. The Williams & Wilkins Co., Baltimore, Md., publishers, 1947. \$10.

This atlas depicts the structures of the human body, region by region, in the same order as a student would dissect it. As such it is a valuable adjunct to the study of anatomy. In addition, there are a liberal number of illustrations depicting the common anomalies which render the book of value to the surgeon. The sections treating the wrists and the cranial nerves are particularly well done.

The illustrations are clear, concise, and maintain a high degree of accuracy. The observations and comments accompanying the illustrations are of great help in interpreting them. With this aid a comprehensive review of anatomy can be rapidly accomplished.

The Birmingham Revision of the Basle Nomina Anatomica is used throughout the atlas. Where the revised and unrevised terms are substantially different, both terms are used. The index is adequate.

MEDICAL WRITING, the Technic and the Art, by Morris Fishbein, M. D., *Editor, The Journal of the American Medical Association*; with the assistance of Jewel F. Whelan, *Assistant to the Editor*. 2d edition. 292 pages; illustrated. The Blakiston Co., Philadelphia, Pa., publishers, 1948. Price \$4.

The second edition of this well-written and informative book on medical writing has been improved by the use of more legible type and by the addition of a chapter on indexing. As in the first edition, all phases in the preparation of a manuscript are covered. This book should be read by physicians, interns, and medical students. As the author so aptly puts it “* * * the physician who launches into the arena a literary venture poorly clad, unsound in constitution, limping in some of its sections, bruised by bad grammar, inadequately camouflaged in its obvious deficiencies, may expect to have his progeny returned with the simple but trite statement ‘The editor regrets * * *’.”

UNDERSTANDABLE PSYCHIATRY, by Leland E. Hinsie, M. D., *Professor of Psychiatry, College of Physicians and Surgeons, Columbia University; Assistant Director, New York State Psychiatric Institute and Hospital*. 359 pages. The Macmillan Co., New York, N. Y., publishers, 1948. Price \$4.50.

Written for the laity as well as for the physician who seeks an understanding of the fundamentals of psychiatry, Dr. Hinsie, in a clearly understandable and in a most interesting manner, describes the relationship of the disturbed emotions to the conscious and unconscious minds and how functional changes of organs and of the mind ensue. The organic factors that produce alterations of the organization and function of the mind are also thoroughly discussed. The extremely interesting case histories that are presented simulta-

neously are of great aid in emphasizing the essential features of many of the conditions under discussion. Treatment is also briefly discussed.

This book is recommended reading for all physicians, the resident, internist, and medical student.

OBSTETRICAL PRACTICE, by Alfred C. Beck, M. D., *Professor of Obstetrics and Gynecology, Long Island College of Medicine; Obstetrician and Gynecologist-in-Chief, Long Island College Hospital, Brooklyn, N. Y.* 4th edition. 966 pages; more than 1,000 illustrations. The Williams & Wilkins Co., Baltimore, Md., publishers, 1947. Price \$7.

A concise, factual, and well-written textbook on obstetrics. The chapter on the management of pregnancy is covered very thoroughly as are also the chapters on the management of labor. It is in the chapters devoted to the mechanism of labor that the hand-drawn illustrations are used to such good advantage.

The chapter on analgesia, amnesia, and anesthesia is presented in a clear and very practical manner.

There is adequate bibliography at the end of each chapter.

This is an excellent textbook on obstetrics and is recommended for the medical student, the intern, and the busy practitioner.

CINEPLASTY, by Henry H. Kessler, M. D., Ph. D., *formerly Captain (MC) U. S. N. R.; formerly Chief of Amputation Center, United States Naval Hospital, Mare Island, California; Orthopedic and Amputation Consultant to the Office of Vocational Rehabilitation; Member of New Jersey Rehabilitation Commission; Diplomate of American Board of Orthopedic Surgery.* Foreword by Ross T. McIntire, Vice Admiral (MC) U. S. N., The Surgeon General, United States Navy. 201 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1947. Price \$6.75.

This concise and well-written book describes various plastic procedures and surgical and prosthetic methods for overcoming the physical disability occasioned by the traumatic loss or the congenital absence of an extremity. Dr. Kessler's wide experience in this field of orthopedic surgery in civilian life and in the Navy is reflected in the excellent manner in which he handles this most important subject. The chapter on rehabilitation points out the necessity for instructing the patient in the readjustment of his mental outlook and physical capabilities in order to assume his rightful position in the social and economic world. This is an excellent book for the young orthopedic surgeon or the resident in orthopedics.

PHARMACOLOGY, THERAPEUTICS AND PRESCRIPTION WRITING, by Walter A. Bastedo, Ph. G., M. D., Sc. D., F. A. C. P., *Associate in Pharmacology and Therapeutics, and Assistant Professor of Medicine, Columbia University.* 5th edition. 840 pages; charts and other illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$8.50.

A review of this standard and well-known book is superfluous. Its many excellent features are well known. The principal change in this fifth edition is the addition of new drugs, including rutin, BAL, helium, and the coagulants.

SIGNS AND SYMPTOMS, Their Clinical Interpretation, by 21 contributors. Edited by Cyril Mitchell MacBryde, A. B., M. D., F. A. C. P., *Assistant Professor of Clinical Medicine, Washington University School of Medicine; Assistant Physician, Barnes Hospital, St. Louis, Mo.* 439 pages; 74 illustrations in black and white and 12 subjects in color on 6 plates. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$12.

An excellent treatise on the clinical interpretation of the more common complaints which bring the patient to the physician. The chapters take up successively such symptoms as pain, cough, hemoptysis, loss of consciousness, palpitation, tachycardia, and the numerous other complaints. The symptoms are thoroughly correlated with the normal and pathologic physiology of the organs.

The book is well written, the material is well presented, and the references are adequate. It may be well to point out the statement on page 85: "In all cases in which a segmented appendix is visualized by roentgenogram and the usual treatment for unstable colon fails to relieve intermittent pain in the right lower quadrant, appendectomy should be done." This doctrinaire entirely ignores the lesions of the kidney, ureter, and lesions of other anatomical structures located in the right side of the abdomen which may give rise to identical symptoms.

This book is an excellent ready reference for diagnosis and is recommended for the general practitioner, intern, and medical student.

ENCYCLOPEDIA OF MEDICAL SOURCES by Emerson Crosby Kelly, M. D., F. A. C. S., *Associate Professor of Surgery, Albany Medical College; Attending Surgeon, Albany Hospital; Editor, Medical Classics.* 476 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1948. Price \$7.50.

This book contains a complete reference to the outstanding contributions and contributors to medical knowledge. The names of the contributors are arranged alphabetically while the index lists disorders, operations, signs, tests, syndromes, and methods, thus providing a completely cross-referenced volume of medical sources.

This book is recommended for research workers, the student, and the medical writer, and is a most valuable addition to the medical library.

SOURCE BOOK OF ORTHOPAEDICS, by Edgar M. Bick, M. A., M. D., F. A. C. S., *Diplomate Orthopedic Surgery, Associate Orthopedic Surgeon, The Mount Sinai Hospital, New York; Fellow American Academy Orthopedic Surgeons, Fellow in Orthopedic Surgery, New York Academy of Medicine, One time Regional Consultant Orthopedic Surgeon (Army), European Theatre of Operation.* 2d edition. 540 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1948. Price \$8.

A history of orthopedic surgery dealing with the origin, originators, and source of numerous orthopedic conditions and operative procedures, including mechanical and physical therapy. The period covered extends from ancient times to the most recent dates. Many original discoveries and observations in medicine relating to the development of orthopedics are also noted. The bibliography is ample.

This is an excellent reference book for the orthopedic surgeon, and should be included in the collection of every medical library as well.

MINOR SURGERY, by Frederick Christopher, B. S., M. D., F. A. C. S., *Associate Professor of Surgery, Northwestern University Medical School; Chief Surgeon, Evanston (Illinois) Hospital*. 6th edition. 1,058 pages; 937 illustrations on 595 figures. W. B. Saunders Co., Philadelphia, Pa., publishers, 1948. Price \$12.

The sixth edition of this excellent and well known textbook on minor surgery deserves praise for the very practical manner in which the subject is handled. Dr. Christopher has utilized many authoritative sources and has chosen the most direct and up-to-date forms of treatment. The addition of a complete and excellent bibliography of some 3,000 references enhances the value of this book. It is heartily recommended to the general practitioner, the resident, intern, and medical student.

ELECTROCARDIOGRAPHY, Including an Atlas of Electrocardiograms, by Louis N. Katz, A. B., M. A., M. D., F. A. C. P., *Director of Cardiovascular Research, Michael Reese Hospital, Chicago, Ill.* 2d edition, thoroughly revised. 883 pages; 525 engravings, including over 1,000 electrocardiograms. Lea & Febiger, Philadelphia, Pa., publishers, 1946. Reprinted 1947. Price \$12.

This volume is a complete textbook on electrocardiography. It is presented in three sections, namely: (1) the theoretical aspects; (2) the contours of the electrocardiogram encountered in health and disease; and (3) a systematic presentation of the electrocardiographic diagnosis of the arrhythmias.

The text is well arranged and each subject is summarized in table form which facilitates quick reference.

This second edition eliminates obsolete material and contains descriptions of newer concepts.

Over 1,000 electrocardiograms are included and described fully. They are so arranged that the volume can be used either as an atlas or as a text.

This revised volume brings electrocardiography up to date by adopting the universal terminology and modifying our previous conceptions with new knowledge gained by the mass examination of normal youths for military service.

It is a valuable book and should be on the shelves of instructors and consultants in cardiology as well as a reference book for students.

HANDBOOK OF COMMUNICABLE DISEASES, by Franklin H. Top, A. B., M. D., M. P. H., F. A. C. P., *Medical Director, Herman Kiefer Hospital; Clinical Professor of Preventive Medicine and Public Health, Wayne University College of Medicine; Extramural Lecturer in Infectious Diseases and Epidemiology, School of Public Health, University of Michigan; Consultant, Preventive Medicine Section, Surgeon General's Office, United States Army*; and 20 collaborators. 2d edition. 992 pages; 95 illustrations, 13 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$8.50.

Four members of the nursing profession and 16 physicians collaborated with the author and have presented their subjects in a very scientific, interesting, and concise manner.

Three chapters have been completely rewritten, 14 new ones added, and the remaining 43 brought up to date.

Classification of diseases by common portal of entry makes this presentation helpful to students.

The first seven chapters are devoted to general considerations applicable to communicable diseases and includes two chapters devoted entirely to nursing problems.

Two chapters describe the care and after care of poliomyelitis, with a brief discussion of the Kenny treatment and theory.

The appendix contains interesting statistical data gathered by the author from the Herman Kiefer Hospital.

There are many references for those interested in more thorough coverage of each subject discussed.

The book is recommended for all medical officers and for those interested in communicable diseases.

ROENTGEN DIAGNOSIS OF DISEASES OF THE GASTROINTESTINAL TRACT, by John T. Farrell, Jr., M. D., *Clinical Professor of Radiology, Graduate School of Medicine, University of Pennsylvania*. 271 pages; illustrated. Charles C Thomas, Springfield, Ill., publisher, 1946. Price \$5.50.

This is a small, handy manual on an important subject and serves the purpose of providing a complete résumé, excellently and comprehensively illustrated. The presentation is highly concentrated, didactic and without elaborate discussion. The printing is easy on the eyes and there is abundant use of bold-faced type and columnizing, by way of providing emphasis and "catching" the eye.

The text is systematically arranged, professionally up-to-date, and appears to represent accurately the best scientific opinions of the day.

In general, this is an excellent example of condensation and is splendidly adapted to teaching needs. It is not designed as a replacement for more comprehensive texts but should prove, nevertheless, a very helpful ready reference.

EXERCISES IN ELECTROCARDIOGRAPHIC INTERPRETATION, by Louis N. Katz, A. B., M. A., M. D., F. A. C. P., *Director of Cardiovascular Research, Michael Reese Hospital, Chicago, Ill.* 2d edition, thoroughly revised. 288 pages; 141 engravings including 166 electrocardiograms. Lea & Febiger, Philadelphia, Pa., publishers, 1946. Reprinted 1947. Price \$6.

This is a companion volume by the same author entitled "Electrocardiography."

As the name implies, this volume contains case histories and electrocardiograms of the various cardiac lesions and arrhythmias, for continuation of the study of electrocardiography, by actual case history review.

This book is unique because it associates the case history with the tracing. Too often a diagnosis is dependent on an instrumental finding without associating the clinical history or findings. This book fulfills a definite need and is excellent for teaching. The revision has become necessary in order to conform with newer terminology and the newer electrocardiographic knowledge and interpretation.

BOOK NOTICES

Receipt of the following books is acknowledged. As far as practicable, these will be reviewed at a later date.

HANDBOOK OF OPHTHALMOLOGY, by Everett L. Goar, A. B., M. D., F. A. C. S., *Professor of Ophthalmology, Baylor University College of Medicine, Houston, Tex.* 166 pages, 45 illustrations, 7 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1948. \$5.50.

HEADACHE, by Louis G. Moench, M. D., *Assistant Clinical Professor of Medicine, University of Utah School of Medicine; Internist, Salt Lake Clinic, Salt Lake City.* 207 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., publisher, 1947. Price \$3.50.

BRIEF PSYCHOTHERAPY, A Handbook for Physicians on the Clinical Aspects of Neuroses, by Bertrand S. Frohman, M. D., with the collaboration of Evelyn P. Frohman. Foreword by Walter C. Alvarez, M. D. 265 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1948. Price \$4.

SYMPTOMS AND SIGNS IN CLINICAL MEDICINE, an Introduction to Medical Diagnosis, by E. Noble Chamberlain, M. D., M. Sc., F. R. C. P., *Lecturer in Medicine, University of Liverpool; Physician to Out-patients, Royal Liverpool United Hospital, Royal Infirmary Branch; Visiting Physician, Smith-down Road Hospital, Liverpool; Formerly Beit Memorial Research Fellow.* 4th edition. 463 pages; 346 illustrations, of which 19 are in color. The Williams & Wilkins Co., Baltimore, Md., publisher, 1947. Price \$8.

REHABILITATION THROUGH BETTER NUTRITION, University of Cincinnati Studies in Nutrition at the Hillman Hospital, Birmingham, Ala., by Tom D. Spies, M. D., *Department of Internal Medicine, University of Cincinnati College of Medicine.* 94 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$4.

- FUNDAMENTALS OF NEUROLOGY**, by Ernest Gardner, M. D., *Assistant Professor of Anatomy, Wayne University College of Medicine, Detroit, Mich.* 336 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$4.75.
- PROFESSIONAL ADJUSTMENTS**, by Sister Mary Isidore Lennon, R. S. M., R. N., B. S., M. A., *Director of St. John's Hospital School of Nursing, 1939-45; Director of Social Service Department, St. John's Hospital, St. Louis.* 299 pages. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$3.
- MALARIA CONTROL ON IMPOUNDED WATER**, Prepared by the Federal Security Agency, United States Public Health Service and Tennessee Valley Authority, 1947. 422 pages. For Sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price \$2.
- CARE OF THE BREAST**, by Else K. La Roe, M. D. 240 pages; illustrated. Froben Press, publishers, New York, N. Y., 1947. Price \$3.75.
- THE FOOT AND ANKLE**, Their Injuries, Diseases, Deformities and Disabilities, by Philip Lewin, M. D., F. A. C. S., *Associate Professor of Bone and Joint Surgery, and Acting Head of Department, Northwestern University Medical School; Professor of Orthopaedic Surgery, Post-Graduate Medical School of Cook County Hospital; Attending Orthopaedic Surgeon, Cook County Hospital; Senior Attending Orthopaedic Surgeon, Michael Reese Hospital, Consulting Orthopaedic Surgeon, Municipal Contagious Disease Hospital, Chicago; Army of United States.* 3d edition, thoroughly revised. 847 pages; 389 illustrations. Lea & Febiger, Philadelphia, Pa., publisher, 1947. Price \$11.
- ARTERIAL HYPERTENSION**, by David Ayman, M. D., *Instructor in Medicine, Tufts College Medical School, Associate Visiting Physician and Head of Out-Patient Clinic in Hypertension, Beth Israel Hospital, Boston, Mass.* Edited by Henry A. Christian, A. M., M. D., LL. D., Sc. D. (Hon.), M. A. C. P., Hon. F. R. C. P. (Can.), D. S. M. (Am. Med. Assoc.), *Hersey Professor of the Theory and Practice of Physics Emeritus, Harvard University; Sometime Clinical Professor of Medicine, Tufts College Medical School; Physician-in-Chief, Emeritus, Peter Bent Brigham Hospital; Sometime Visiting Physician, Beth Israel Hospital, Boston, Mass.* (Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as in that work.) 57 pages. Oxford University Press, New York, N. Y., publishers, 1948. Price \$2.50.
- THE ANATOMY OF THE EYE AND ORBIT**, Including the Central Connections, Development, and Comparative Anatomy of the Visual Apparatus, by Eugene Wolff, M. B., B. S. (Lond.), F. R. C. S. (Eng.), *Ophthalmic Surgeon, Royal Northern Hospital; Surgeon, Pathologist and Lecturer in Anatomy to the Westminster Branch of the Moorfields, Westminster and Central Eye Hospital; Late Demonstrator of Anatomy, University College; Late Chief Clinical Assistant, Royal London Ophthalmic Hospital (Moorfields) and Ophthalmic Registrar, University College Hospital.* 3d edition. 440 pages; 323 illustrations, 24 in color. The Blakiston Co., Philadelphia, Pa., publishers, 1948. Price \$12.

PHYSICAL TREATMENT OF INJURIES OF THE BRAIN AND ALLIED NERVOUS DISORDERS, by K. M. Hern, M. C. S. P., Diploma of Liverpool Physical Training College, *in Charge of Physiotherapy Dept., Military Hospital (Head Injuries), Oxford*. Foreword by Air Vice Marshal Sir Charles P. Symonds, K. B. E., C. B., D. M., F. R. C. P. 96 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1947. Price \$4.

PRACTICAL MALARIOLOGY, Prepared Under the Auspices of the Division of Medical Sciences of the National Research Council, by Paul F. Russell, M. D., M. P. H., Colonel, M. C., A. U. S., *Parasitology Division, The Army Medical School, Field Staff, International Health Division, Rockefeller Foundation (on leave)*; Luther S. West, Ph. D., *Head of Biology Department, Northern Michigan College of Education, Major, Sn. C., A. U. S. (Reserve)*; *Formerly Entomologist, Parasitology Division, Army Medical School*; and Reginald D. Manwell, Sc. D., *Professor of Zoology, Syracuse University, New York, Formerly Captain, Sn. C., A. U. S., Protozoology Section Parasitology Division, Army Medical School*. Foreword by Raymond B. Fosdick, *President of The Rockefeller Foundation*. 684 pages; with 238 illustrations, 8 in color. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$8.

TEXTBOOK OF THE NERVOUS SYSTEM, a Foundation for Clinical Neurology, by H. Chandler Elliott, M. A., Ph. D., *Assistant Professor of Anatomy, Medical College of the State of South Carolina*. Introduction by Wilder Penfield, M. D. 384 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$8.

PHYSIOLOGIC THERAPY IN RESPIRATORY DISEASES, by Alvan L. Barach, M. D., *Associate Professor of Clinical Medicine, Columbia College of Physicians and Surgeons; Assistant Attending Physician, Presbyterian Hospital, New York, N. Y.* 2d edition. 408 pages; with 74 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1948. Price \$9.

NEUROPATHOLOGY, by I. Mark Scheinker, M. D., *Assistant Professor of Medicine (Neurology) and Instructor in Neuropathology, University of Cincinnati, College of Medicine, Neuropathologist and Attending Neurologist, Cincinnati General Hospital*; Foreword by Tracy J. Putnam, M. D., *Professor of Neurology and Neurological Surgery, College of Physicians and Surgeons, Columbia University, Director of Services of Neurology and Neurological Surgery, Neurological Institute of New York*. 306 pages; 1st edition; illustrated. Charles C Thomas, Springfield, Ill., published, 1947. Price \$6.75.

PSYCHOBIOLOGY AND PSYCHIATRY, A Textbook of Normal and Abnormal Human Behavior, by Wendell Muncie, M. D., *Associate Professor of Psychiatry, Johns Hopkins University; Assistant Psychiatrist, Henry Phipps Psychiatric Clinic, Johns Hopkins Hospital*. With a foreword by Adolf Meyer, M. D., LL. D., Sc. D., *Henry Phipps Professor of Psychiatry and Director of the Department of Psychiatry, Johns Hopkins University*. 2d edition. 620 pages; 70 illustrations. The C. V. Mosby Company, St. Louis, Mo., publisher, 1948. Price \$9.

THE LESSON OF OKINAWA, by Newton Dillaway. 33 pages; illustrated. The Montrose Press, Wakefield, Mass., publishers, 1947. Price \$2.

THE PARATHYROID GLANDS AND SKELETON IN RENAL DISEASE, by J. R. Gilmour, M. R. C. P., *Pathologist in Emergency Medical Service; Junior Assistant Director, Bernhard Baron Institute of Pathology, London Hospital*. 157 pages, illustrated. Oxford University Press, New York, N. Y., publishers, 1947. Price \$5.75.

PENICILLIN THERAPY, Including Streptomycin, Tyrothricin and Other Antibiotic Therapy, by John A. Kolmer, M. S., M. D., Dr. P. H., Sc. D., LL. D., L. H. D., F. A. C. P., *Professor of Medicine in the School of Medicine and the School of Dentistry, Temple University; Director of the Research Institute of Cutaneous Medicine; formerly Professor of Pathology and Bacteriology, Graduate School of Medicine, University of Pennsylvania*. 2d edition. 339 pages; illustrated. D. Appleton-Century Co., Inc., New York, N. Y., publishers, 1947. Price \$6.

THE CHEMICAL COMPOSITION OF FOODS, by R. A. McCance and E. M. Widdowson. 2d edition. 156 pages. His Majesty's Stationery Office, London, England, publishers, 1946. Price 6s. Od. net.

THE PATHOLOGY OF NUTRITIONAL DISEASE, Physiological and Morphological Changes Which Result from Deficiencies of the Essential Elements, Amino Acids, Vitamins, and Fatty Acids, by Richard H. Follis, Jr., M. D., *Associate Professor of Pathology, Duke University School of Medicine, Durham, North Carolina*. 291 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1948. Price \$6.75.

THE DISSECTION OF THE CAT (FELIS DOMESTICA), A Laboratory Manual, by Bruce M. Harrison, Ph. d., *Professor of Zoology and Head of Department, The University of Southern California, Los Angeles, Calif.* 109 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1948. Price \$3.50.

TAKING THE CURE, The Patient's Approach to Tuberculosis, by Robert G. Lovell, M. D., *University Hospital, University of Michigan, Ann Arbor, Mich.* 93 pages; illustrated by Donald Gooch. The Macmillan Co., New York, N. Y., publishers, 1948. Price \$2.

EATING FOR HEALTH, by Pearl Lewis, B. S., Consultant Dietitian. 121 pages. The Macmillan Co., New York, N. Y., publishers, 1948. Price \$2.25.



INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 48

INDEX TO SUBJECTS

	Page
Abscess, liver.....	7
Abscess, metastatic brain, originating in lungs, treated with massive doses of penicillin; report of case.....	778
Acquired forehead defects, repair of, by tantalum cranioplasty and plastic surgery; report of 2 cases.....	773
Activities, anesthesia, aboard U. S. S. " <i>Benevolence</i> ".....	190
Acuminata, massive condylomata.....	831
Acute appendicitis developing during penicillin therapy for suppurative infection; report of case.....	879
Acute appendicitis during penicillin therapy for syphilis; report of case....	881
Acute appendicitis, pseudohemophilia; report of case simulating.....	616
Acute disseminated lupus erythematosus with fatal termination.....	286
Acute empyema thoracis, nonoperative treatment of, with penicillin; discussion of its limitations and subsequent surgical management of its failures.....	513
Acute respiratory diseases in United States Naval training center, spread of Influenza A and other.....	478
Acute sacrococcygeal cyst teratoma, treatment of.....	250
Administration of penicillin solution, dermatitis due to preparation and....	391
Advances in medicine, ten greatest (editorial).....	769
Advances in treatment of paraplegics (editorial).....	95
Air, normal, after exposure to atmosphere having high concentration of carbon dioxide, study of effect of breathing oxygen or.....	234
Airborne photofluorographic unit.....	496
Alveolectomy, technique for.....	847
Amebiasis, hepatic.....	22
American Board of Ophthalmology, examinations by (editorial).....	270
Amphibious operations, dental logistics in.....	528
Analysis of submarine food problems in World War II.....	683
Anaphylaxis, fatal, following typhus vaccine injection.....	303
Anesthesia activities aboard U. S. S. " <i>Benevolence</i> ".....	190
Anesthesia, use of curare in, in United States Naval hospital.....	668
Anesthetics, local, toxicity of.....	871
Anterior teeth, impacted, surgical removal of odontoma and; report of case.....	116
Antirabies vaccine, encephalitis due to; report of case.....	620
Anti-Rh sera from placental tissue of sensitized women, production of....	370

Anuria, sulfadiazine; its relief by bilateral renal decapsulation and nephrostomy.....	Page 448
Aphorisms on peptic ulcer seen in naval service.....	207
Appendicitis, acute, developing during penicillin therapy for suppurative infection; report of case.....	879
Appendicitis, acute, during penicillin therapy for syphilis; report of case..	881
Appendix, where is the (editorial).....	266
Applicants sought for commissions in naval Medical Service Corps (editorial).....	98
Application of DDT in field, two methods for.....	797
Articles of special merit published in U. S. Naval Medical Bulletin during 1947 (editorial).....	96
Ascites, spontaneous chylous; report of case.....	794
Atmosphere having high concentration of carbon dioxide, study of effect of breathing oxygen or normal air after exposure to.....	234
Bacillary dysentery.....	818
Benadryl in therapy of rheumatic fever, observations on efficacy of.....	380
<i>Benevolence</i> , U. S. S., anesthesia activities aboard.....	190
Benign tumors of testis; report of case.....	893
Bilateral ureterosigmoidostomy for carcinoma of bladder, total cystectomy with.....	601
Bipartite patellae, interesting notes on.....	229
Births in United States in 1947, number of (editorial).....	443
Bismuth vs. penicillin, therapy of throat infections with (WARNING concerning use, p. 414).....	61
Bladder, carcinoma of, total cystectomy with bilateral ureterosigmoidostomy for.....	601
Blood substitutes in treatment of burns, fluids and (editorial).....	99
Board of Ophthalmology, American, examinations by (editorial).....	270
Bone, carpal navicular, radiographic study of fractures of.....	66
Brain abscess, metastatic, originating in lungs, treated with massive doses of penicillin; report of case.....	778
Breathing oxygen or normal air after exposure to atmosphere having high concentration of carbon dioxide, study of effect of.....	234
Bronchogenic carcinoma, review of present methods in early diagnosis of..	198
Bronchiogenic cysts of mediastinum; report of case.....	107
Burn, chemical, of esophagus; report of case from occupation forces in Japan.....	118
Burns, treatment of, fluids and blood substitutes in (editorial).....	99
Canal fillings, root, in infected pulpless teeth; preliminary report.....	868
Cancer cells, detection of; smear technique.....	843
Cancer, challenge of (editorial).....	948
Carbon dioxide, study of effect of breathing oxygen or normal air after exposure to atmosphere having high concentration of.....	234
Carcinoma, bronchogenic, review of present methods in early diagnosis of..	198
Carcinoma of bladder, total cystectomy with bilateral ureterosigmoidostomy for.....	601
Cardiac and electrocardiographic observations on American prisoners of war repatriated from Japan.....	69
Carpal navicular bone, radiographic study of fractures of.....	66

Carriers of "Shigella flexneri III" following an epidemic, prolonged laboratory observations on clinical cases and	Page 405
Case, clinical, for diagnosis, what is it?	941
Case of migraine with lesion localized in visual tract	290
Cases, clinical, and carriers of "Shigella flexneri III" following an epidemic, prolonged laboratory observations on	405
Cause of limitations of knee motion after fracture of shaft of femur (editorial)	440
Cell-free preparations, formation of phage in	510
Cells, cancer, detection of; smear technique	843
Central retinal vein, occlusion of; report of case treated with heparin	912
Cerebrospinal meningitis, epidemic, (Waterhouse-Friderichsen's syndrome); report of two successfully treated cases and one fatal case	907
Challenge of cancer (editorial)	948
Chancroidal ulcers, efficacy of penicillin iontophoresis in treatment of; ion transfer of penicillin	40
Chemical burn of esophagus; report of case from occupation forces in Japan	118
Chorioretinitis juxtapapillaris (Jensen's disease)	610
Chylous ascites, spontaneous; report of case	794
Citrus fruit consumption, dental observations of native Puerto Ricans with special reference to their habits of	698
Clinical cases and carriers of "Shigella flexneri III" following an epidemic, prolonged laboratory observations on	405
Clinical cases, correct diagnosis for (editorial)	446
Clinical case for diagnosis; what is it?	434, 941
Clinical pathological conference	569
Combat fatigue, treatment of, use of plasma in	226
Commissions in naval Medical Service Corps, applicants sought for (editorial)	98
Concentration, high, of carbon dioxide, study of effect of breathing oxygen or normal air after exposure to atmosphere having	234
Concentration of grouping serum for group "A" hemolytic streptococci	641
Concepts, present-day, of epidemiology	386
Condylomata acuminata, massive	831
Conference, clinical pathological	569
Conservative treatment of placenta previa (editorial)	267
Control, venereal disease, by punishment	919
Correct diagnosis for clinical cases (editorial)	446
Cotton knots	93
Court martial probation, general, study of 200 violators of	81
Cowpox vaccine, treatment of herpes zoster with; herpes zoster following exposure of varicella	742
Cranioplasty, tantalum, and plastic surgery, repair of acquired forehead defects by; report of 2 cases	773
Cruiser in Apra Harbor, Guam, Marianas Islands, dysentery outbreak aboard	240
Crush, phrenic, and pneumoperitoneum therapy; report of two cases, discussion of pulmonary tuberculosis treated with	454
Curare in anesthesia in United States naval hospital, use of	668
Cyst teratoma, acute sacrococcygeal, treatment of	250
Cystectomy, total, with bilateral ureterosigmoidostomy for carcinoma of bladder	601
Cysts, bronchiogenic, of mediastinum; report of case	107

	Page
DDT in field, two methods for application of.....	797
Deafness, progressive, modern treatment of.....	1
Deaths, medical and dental officer, to be published in U. S. Naval Medical Bulletin (editorial).....	100
Deaths, notices of, in Medical and Dental Corps..... 101, 271, 447, 600, 772,	950
Decapsulation, bilateral renal, relief of sulfadiazine anuria by nephro- stomy and.....	448
Decortication of lung in organizing hemothorax and empyema.....	52
Defects, acquired forehead, repair of, by tantalum cranioplasty and plastic surgery; report of two cases.....	773
Defects, persisting ocular, in Pacific war prisoners.....	538
Defects, surface, of lower extremities, use of pedicle skin grafts in repair of.....	373
Defects, surface, of lower extremity, plastic repair of.....	823
Delayed reaction to penicillin; report of four cases.....	887
Dental infections, use of penicillin in.....	120
Dental logistics in amphibious operations.....	528
Dental observations of native Puerto Ricans with special reference to their habits of citrus fruit consumption.....	698
Dental School, University of Pennsylvania, modification of oral photo- graphic apparatus originally constructed by.....	312
Dermatitis due to preparation and administration of penicillin solution...	391
Detection of cancer cells; smear technique.....	843
Diagnosis, clinical cases for; what is it?.....	434, 941
Diagnosis, correct, for clinical cases (editorial).....	446
Diagnosis, early, of bronchogenic carcinoma, review of present methods in.....	198
Diagnosis of scabies, rapid technique for.....	566
Diarrhea, epidemic, of newborn (editorial).....	266
Diet, individualism in (editorial).....	444
Discussion of pulmonary tuberculosis treated with phrenic crush and pneu- moperitoneum therapy; report of two cases.....	454
Discussion of Reiter's syndrome, report of case.....	503
Disease, Hodgkin's.....	180
Disease, Hodgkin's, involving epicardium; report of case.....	272
Diseases of leading importance to Navy.....	153
Diseases, other acute respiratory, in United States naval training center, spread of Influenza A and.....	478
Disease, Reiter's; a review with presentation of case.....	463
Disease, venereal, among naval prisoners.....	722
Disease, venereal, control by punishment.....	919
Dislocation, simple, of talus without fracture; report of case.....	914
Dispensary, naval station.....	76
Diverticulum, Meckel's, traumatic rupture of mesentery of; report of case.....	467
Doses, massive, of penicillin, metastatic brain abscess originating in lungs, treated with; report of case.....	773
Drowning in salt and fresh water (editorial).....	595
Dysentery, bacillary.....	818
Dysentery outbreak aboard cruiser in Apra Harbor, Guam, Marianas Islands.....	240
Early diagnosis of bronchogenic carcinoma, review of present methods in.....	198
Edentulous mandibles, treatment of fractures of; a review.....	415
Effect of breathing oxygen or normal air after exposure to atmosphere having high concentration of carbon dioxide, study of.....	234

	Page
Efficacy of Benadryl in therapy of rheumatic fever, observations on.....	380
Electrocardiographic observations on American prisoners of war repatriated from Japan, cardiac and.....	69
Electrodiagnosis in peripheral nerve lesions.....	838
Empyema, hemothorax and, decortication of lung in organizing.....	52
Empyema thoracis, acute, nonoperative treatment of, with penicillin; discussion of its limitations and subsequent surgical management of its failures.....	513
Encephalitis due to antirabies vaccine; report of case.....	620
Epicardium, Hodgkin's disease involving, report of case.....	272
Epidemic cerebrospinal meningitis (Waterhouse-Friderichsen's syndrome); report of two successfully treated cases and one fatal case.....	907
Epidemic diarrhea of newborn (editorial).....	266
Epidemic, prolonged laboratory observations on clinical cases and carriers of "Shigella flexneri III" following an.....	405
Epidemiology, present-day concepts of.....	386
Epidermolysis bullosa hereditaria.....	112
Esophagus, chemical burn of; report of case from occupation forces in Japan.....	118
Ethnology, medical, and the naval medical officer (editorial).....	771
Etiologic agent, salmonella osteomyelitis; report of a case with <i>Salmonella schottmülleri</i> as.....	306
Examinations by American Board of Ophthalmology (editorial).....	270
Exposure to varicella, herpes zoster following; treatment of herpes zoster with cowpox vaccine.....	742
Extremities, lower, use of pedicle skin grafts in repair of surface defects of..	373
Extremity, lower, plastic repair of surface defects of.....	823
Fatal anaphylaxis following typhus vaccine injection.....	303
Fatal termination, acute disseminated lupus erythematosus with.....	286
Fatigue, combat, use of plasma in treatment of.....	226
Femur, cause of limitations of knee motion after fracture of shaft of (editorial).....	440
Femur, fractures of, intramedullary fixation of.....	161
Fever, rheumatic, observations on efficacy of Benadryl in therapy of.....	380
Fever, yellow, treatment of (editorial).....	269
Filariasis studies in American Samoa.....	327
Fillings, root canal, in infected pulpless teeth; preliminary report.....	868
First Maritime hospital and second oldest hospital in New World (in Santos, Brazil).....	437
Fixation, intramedullary, of fractures of femur.....	161
Fixation of mandibular fractures, report of 3 cases.....	278
Fluids and blood substitutes in treatment of burns (editorial).....	99
Food problems in World War II, analysis of submarine.....	683
Forehead defects, acquired, repair of, by tantalum cranioplasty and plastic surgery; report of two cases.....	773
Formation of phage in cell-free preparations.....	510
Fractures, mandibular, fixation of, report of 3 cases.....	278
Fractures of carpal navicular bone, radiographic study of.....	66
Fractures of edentulous mandibles; a review, treatment of.....	415
Fractures of femur, intramedullary fixation of.....	161
Fracture of shaft of femur, cause of limitations of knee motion after (editorial).....	440

	Page
Fresh water, drowning in salt and (editorial).....	595
Frostbite, treatment of (editorial).....	99
Ganglioneuroma; report of case of intrathoracic ganglioneuroma.....	298
Gastritis, hemorrhage associated with; review of literature and report of two cases.....	253
Gastro-enteritis outbreak due to powdered milk.....	342
General court martial probation, study of 200 violators of.....	81
General information regarding tropical hygiene and living in tropics.....	258
General principles and purposes of tracer studies.....	649
Glomus tumor with report of case.....	901
Grafts, pedicle skin, in repair of surface defects of lower extremities, use of.....	373
Granuloma inguinale and lymphogranuloma venereum (editorial).....	265
Guam, Apra Harbor, Marianas Islands, dysentery outbreak aboard cruiser in.....	240
Guam, tuberculosis program on, including all-island tuberculin patch test study.....	700
Gyro laboratory, potential mercury vapor hazard in.....	139
Habits of citrus fruit consumption, dental observations of native Puerto Ricans with special reference to their.....	698
Handbook of Hospital Corps, revision of (editorial).....	97
Hazard, potential mercury vapor, in Gyro laboratory.....	139
Healing, rapid, of perforating peptic ulcer following vagotomy; report of case.....	792
Health record, history of (editorial).....	597
Health services program in Trust Territory of Pacific Islands.....	925
Heart, metastatic tumor in, report of case.....	275
Hemolytic streptococci, concentration of grouping serum for group "A".....	641
Hemorrhage associated with gastritis; review of literature and report of two cases.....	253
Hemothorax and empyema, decortication of lung in organizing.....	52
Heparin, report of case treated with; occlusion of central retinal vein.....	912
Hepatic amebiasis.....	22
Herpes zoster following exposure to varicella; treatment of herpes zoster with cowpox vaccine.....	742
Hippocrates, oath of (editorial).....	441
History, medical, of Navy—World War II (editorial).....	268
History of health record (editorial).....	597
History of Medical Department, 1898-1948.....	435
Hodgkin's disease.....	180
Hodgkin's disease involving epicardium; report of case.....	272
Hospital Corps, revision of handbook of (editorial).....	97
Hyaluronidase, use of.....	865
Hygiene, tropical, and living in tropics, general information regarding.....	258
Immunization against poliomyelitis (editorial).....	441
Impacted anterior teeth, surgical removal of odontoma and; report of case.....	116
Importance of leprosy in orthopedic surgery.....	656
Importance to Navy, diseases of leading.....	153
Individualism in diet (editorial).....	444
Infected pulpless teeth, root canal fillings in; preliminary report.....	868

Infection, suppurative, acute appendicitis developing during penicillin therapy for; report of case	Page 879
Infections, dental, use of penicillin in	120
Infections, throat, therapy of, with bismuth vs. penicillin (WARNING concerning use, p. 414)	61
Influenza A and other acute respiratory diseases in United States Naval training center, spread of	478
Information regarding tropical hygiene and living in tropics, general	258
Injection, typhus vaccine, fatal anaphylaxis following	303
Interesting notes on bipartite patellae	229
Intramedullary fixation of fractures of femur	161
Intrathoracic ganglioneuroma, report of case of; ganglioneuroma	298
Iontophoresis, penicillin, efficacy of, in treatment of chancroidal ulcers, ion transfer of penicillin	40
Ion transfer of penicillin; efficacy of penicillin iontophoresis in treatment of chancroidal ulcers	40
Japan, cardiac and electrocardiographic observations on American prisoners of war repatriated from	69
Japan, occupation forces in; report of case from; chemical burn of esophagus	118
Journals, naval medical (editorial)	445
Juxtapapillaris, chorioretinitis (Jensen's disease)	610
Knee motion after fracture of shaft of femur, cause of limitations of (editorial)	440
Knots, cotton	93
Laboratory, Gyro, potential mercury vapor hazard in	139
Laboratory observations, prolonged, on clinical cases and carriers of "Shigella flexneri III" following an epidemic	405
Leprosy in orthopedic surgery, importance of	656
Leprosy, new paths in treatment of (editorial)	595
Lesion localized in visual tract, case of migraine with	290
Lesions, peripheral nerve, electrodiagnosis in	838
Limitations of knee motion after fracture of shaft of femur, cause of (editorial)	440
Liver abscess	7
Local anesthetics, toxicity of	871
Log, wartime, of United States Naval Hospital Ship "Solace" from June 1943; part I	577
Log, wartime, of United States Naval Hospital Ship "Solace" from June 1943; part II	750
Logistics, dental, in amphibious operations	528
Logistics, medical matériel, in United States Navy	353
Lower extremities, use of pedicle skin grafts in repair of surface defects of	373
Lower extremity, plastic repair of surface defects of	823
Lung, decortication of, in organizing hemothorax and empyema	52
Lungs, metastatic brain abscess originating in, treated with massive doses of penicillin; report of case	778
Lupus erythematosus with fatal termination, acute disseminated	286
Lymph node changes, primary splenic neutropenia with concomitant	729
Lymphogranuloma venereum, granuloma inguinale and (editorial)	265

	Page
Mandibles, edentulous, treatment of fractures of; a review.....	415
Mandibular fractures, fixation of, report of 3 cases.....	278
Marihuana, truth about (editorial).....	596
Massive condylomata acuminata.....	831
Massive doses of penicillin, metastatic brain abscess originating in lungs, treated with; report of case.....	778
Mass photofluorography in naval shipyard.....	809
Mass serology, sins of (editorial).....	445
Matériel logistics, medical, in United States Navy.....	353
Meckel's diverticulum; traumatic rupture of mesentery of; report of case.....	467
Mediastinum, brochiogenic cysts of; report of case.....	107
Medical and dental officer deaths to be published in U. S. Naval Medical Bulletin (editorial).....	100
Medical Department, 1898-1948, history of.....	435
Medical Department, U. S. Navy, mission of (editorial).....	594
Medical ethnology and the naval medical officer (editorial).....	771
Medical history of Navy—World War II (editorial).....	268
Medical journals, naval (editorial).....	445
Medical matériel logistics in United States Navy.....	353
Medical Service Corps, naval, applicants sought for commissions in (editorial).....	98
Medical surveys for pulmonary tuberculosis.....	632
Medicine, Nobel Prize in, for 1947 (editorial).....	98
Medicine, ten greatest advances in (editorial).....	769
Meningitis, epidemic cerebrospinal (Waterhouse-Friderichsen's syndrome); report of two successfully treated cases and one fatal case.....	907
Meningococcal meningo-encephalitis; report of case.....	613
Meningo-encephalitis, meningococcal, report of case.....	613
Meningo-encephalitis, primary mumps; review of literature and report of case.....	854
Mercury vapor hazard in Gyro laboratory, potential.....	139
Mesentery of Meckel's diverticulum, traumatic rupture of; report of case.....	467
Mesothelioma of peritoneum.....	787
Metastatic brain abscess originating in lungs, treated with massive doses of penicillin; report of case.....	778
Metastatic tumor in heart; report of case.....	275
Method of treatment, simple efficient; pterygium.....	395
Methods for application of DDT in field, two.....	797
Methods, present, in early diagnosis of bronchogenic carcinoma, review of.....	198
Migraine, case of, with lesion localized in visual tract.....	290
Milk, powdered, gastro-enteritis outbreak due to.....	342
Mission of Medical Department, U. S. Navy (editorial).....	594
Modern treatment of progressive deafness.....	1
Modification of oral photographic apparatus originally constructed by Dental School, University of Pennsylvania.....	312
Mononucleosis, infectious; rupture of spleen in, report of case.....	460
Mumps meningo-encephalitis, primary; review of literature and report of case.....	854
Mumps orchitis treated with reactivated pooled plasma; report of five cases.....	897
Naval Medical journals (editorial).....	445
Naval Medical Service Corps, applicants sought for commissions in (editorial).....	98

	Page
Naval service, aphorisms on peptic ulcer seen in.....	207
Naval station dispensary.....	76
Naval training center, United States, spread of Influenza A and other acute respiratory diseases in.....	478
Navy, diseases of leading importance to.....	153
Navy, United States, medical matériel logistics in.....	353
Navy—World War II, medical history of (editorial).....	268
Nephrostomy, sulfadiazine anuria; its relief by bilateral renal decapsulation and.....	448
Nerve lesions, peripheral, electrodiagnosis in.....	838
Neuropsychiatric screening of million men.....	555
Neutropenia, primary splenic, with concomitant lymph node changes.....	729
Newborn, epidemic diarrhea of (editorial).....	266
New paths in treatment of leprosy (editorial).....	595
Nobel Prize in medicine for 1947 (editorial).....	98
Node changes, concomitant lymph, primary splenic neutropenia with.....	729
Nonoperative treatment of acute empyema thoracis with penicillin; discussion of its limitations and subsequent surgical management of its failures.....	513
Normal air, study of effect of breathing oxygen or, after exposure to atmosphere having high concentration of carbon dioxide.....	234
Notes, interesting, on bipartite patellae.....	229
Notices of deaths in medical and dental Corps..... 101, 271, 447, 600, 772,	950
Number of births in United States in 1947 (editorial).....	443
Oath of Hippocrates (editorial).....	441
Observations, cardiac and electrocardiographic, on American prisoners of war repatriated from Japan.....	69
Observations, dental, of native Puerto Ricans with special reference to their habits of citrus fruit consumption.....	698
Observations on efficacy of Benadryl in therapy of rheumatic fever.....	380
Observations, prolonged laboratory, on clinical cases and carriers of "Shigella flexneri III" following an epidemic.....	405
Occlusion of central retinal vein; report of case treated with heparin.....	912
Ocular defects, persisting, in Pacific war prisoners.....	538
Odontoma and impacted anterior teeth, surgical; removal of; report of case.....	116
Ophthalmology, American Board of, examinations by (editorial).....	270
Oral photographic apparatus originally constructed by Dental School, University of Pennsylvania, modification of.....	312
"Oregon City," U. S. S., outbreak of scarlet fever and sore throats aboard ..	643
Orthopedic surgery, importance of leprosy in.....	656
Osteomyelitis, salmonella, report of case with <i>Salmonella schottmülleri</i> as etiologic agent.....	306
Osteomyelitis, specific therapy in.....	175
Outbreak, dysentery, aboard cruiser in Apra Harbor, Guam, Marianas Islands.....	240
Outbreak, gastro-enteritis, due to powdered milk.....	342
Outbreak of scarlet fever and sore throats aboard U. S. S. "Oregon City" ..	643
Oxygen, study of effect of breathing, or normal air after exposure to atmosphere having high concentration of carbon dioxide.....	234
Pacific Islands, Trust Territory of, health services program in.....	925
Paraplegics, advances in treatment of (editorial).....	95

	Page
Patch test study, tuberculin, tuberculosis program on Guam including all-island.....	700
Patellae, bipartite, interesting notes on.....	229
Pathological conference, clinical.....	569
Pedicle skin grafts in repair of surface defects of lower extremities, use of ..	373
Penicillin, bismuth vs., therapy of throat infections with (WARNING, p. 414).....	61
Penicillin, delayed reaction to; report of four cases.....	887
Penicillin; discussion of its limitations and subsequent surgical management of its failures; nonoperative treatment of acute empyema thoracis with.....	513
Penicillin in dental infections, use of.....	120
Penicillin iontophoresis, efficacy, in treatment of chancroidal ulcers; ion transfer of penicillin.....	40
Penicillin, ion transfer of; efficacy of penicillin iontophoresis in treatment of chancroidal ulcers.....	40
Penicillin, massive doses of, metastatic brain abscess originating in lungs, treated with; report of case.....	778
Penicillin, reactions from, with case report of one fatality.....	883
Penicillin solution, dermatitis due to preparation and administration of ..	391
Penicillin therapy for suppurative infection, acute appendicitis developing during; report of case.....	879
Penicillin therapy for syphilis, acute appendicitis during; report of case ..	881
Peptic ulcer, perforating, rapid healing of, following vagotomy; report of case.....	792
Peptic ulcer seen in naval service, aphorisms on.....	207
Perforating peptic ulcer, rapid healing of, following vagotomy; report of case.....	792
Peripheral nerve lesions, electrodiagnosis in.....	838
Peritoneum, mesothelioma of.....	787
Persisting ocular defects in Pacific war prisoners.....	538
Phage in cell-free preparations, formation of.....	510
Photofluorographic unit, air-borne.....	496
Photofluorography, mass, in naval shipyard.....	809
Phrenic crush and pneumoperitoneum therapy; report of two cases, discussion of pulmonary tuberculosis treated with.....	454
Placenta previa, conservative treatment of (editorial).....	267
Placental tissue of sensitized women, production of anti-Rh sera from.....	370
Plasma, reactivated pooled, mumps orchitis treated with; report of five cases.....	897
Plasma, use of, in treatment of combat fatigue.....	226
Plastic repair of surface defects of lower extremity	823
Plastic surgery, tantalum cranioplasty and, repair of acquired forehead defects by; report of two cases.....	773
Pneumoperitoneum therapy, discussion of pulmonary tuberculosis treated with phrenic crush and; report of two cases.....	454
Poliomyelitis, immunization against (editorial).....	441
Posture (editorial).....	442
Potential mercury vapor hazard in Gyro laboratory.....	139
Powdered milk, gastro-enteritis outbreak due to.....	342
Preparation and administration of penicillin solution, dermatitis due to ..	391
Preparations, cell-free, formation of phage in.....	510

	Page
Present-day concepts of epidemiology.....	386
Present methods in early diagnosis of bronchogenic carcinoma, review of..	198
Primary mumps meningo-encephalitis; review of literature and report of case.....	854
Primary splenic neutropenia with concomitant lymph node changes.....	729
Prisoners, naval, venereal disease among.....	722
Prisoners of war repatriated from Japan, cardiac and electrocardiographic observations on American.....	69
Prisoners, Pacific war, persisting ocular defects in.....	538
Prize, Nobel, in medicine for 1947 (editorial).....	98
Prize, Wellcome, in 1947 (editorial).....	269
Probation, general court martial, study of 200 violators of.....	81
Production of anti-Rh sera from placental tissue of sensitized women....	370
Program in Trust Territory of Pacific Islands, health services.....	925
Prolonged laboratory observations on clinical cases and carriers of "Shigella flexneri III" following an epidemic.....	405
Pseudohemophilia; report of case simulating acute appendicitis.....	616
Pterygium: simple efficient method of treatment.....	395
Puerto Ricans, native, with special reference to their habits of citrus fruit consumption, dental observations of.....	698
Pulmonary tuberculosis; experiences in naval hospital.....	921
Pulmonary tuberculosis, medical surveys for.....	632
Pulmonary tuberculosis; review of sixty-six cases with anatomical findings..	132
Pulmonary tuberculosis, treated with phrenic crush and pneumoperitoneum therapy; report of two cases; discussion of.....	454
Pulpless teeth, infected, root canal fillings in; preliminary report.....	868
Punishment, venereal disease control by.....	919
Questionnaire, results of, in November-December issue of U. S. Naval Medical Bulletin (editorial).....	263
Radiographic study of fractures of carpal navicular bone.....	66
Rapid healing of perforating peptic ulcer following vagotomy; report of case..	792
Rapid technique for diagnosis of scabies.....	566
Reaction, delayed, to penicillin; report of four cases.....	887
Reactions from penicillin with case report of one fatality.....	883
Reactions to suture material (editorial).....	771
Record, health, history of (editorial).....	597
Reiter's disease; a review with presentation of case.....	463
Reiter's syndrome, discussion of, report of case.....	503
Removal, surgical, of odontoma and impacted anterior teeth, report of case..	116
Renal decapsulation, bilateral, and nephrostomy; sulfadiazine anuria; its relief by	448
Repair of acquired forehead defects by tantalum cranioplasty and plastic surgery; report of two cases.....	773
Repair of surface defects of lower extremities, use of pedicle skin grafts in..	373
Repair, plastic, of surface defects of lower extremity.....	823
Repatriated, prisoners of war, from Japan, cardiac and electrocardiographic observations on American.....	69
Respiratory diseases, other acute, in United States Naval training center, spread of influenza A and.....	478
Results of questionnaire in November-December issue of U. S. Naval Medical Bulletin (editorial).....	263

	Page
Retinal vein, central, occlusion of; report of case treated with heparin....	912
Review of present methods in early diagnosis of bronchogenic carcinoma...	198
Revision of Handbook of Hospital Corps (editorial).....	97
Rh, anti-, sera from placental tissue of sensitized women, production of...	370
Rheumatic fever, observations on efficacy of Benadryl in therapy of.....	380
Root canal fillings in infected pulpless teeth; preliminary report.....	868
Rupture of spleen in infectious mononucleosis; report of case.....	460
Rupture, traumatic, of mesentery of Meckel's diverticulum; report of case..	467
Sacrococcygeal cyst teratoma, acute, treatment of.....	250
Salmonella osteomyelitis; report of case with <i>Salmonella schottmüller</i> as etiologic agent.....	306
<i>Salmonella schottmüller</i> as etiologic agent; salmonella osteomyelitis; report of case with.....	306
Salt and fresh water, drowning in (editorial).....	595
Samoa, American, filariasis studies in.....	327
Scabies, diagnosis of, rapid technique for.....	566
Scarlet fever and sore throats aboard U. S. S. "Oregon City," outbreak of..	643
Screening, neuropsychiatric, of million men.....	555
Sensitized women, production of anti-Rh sera from placental tissue of....	370
Sera, anti-Rh, from placental tissue of sensitized women, production of...	370
Serology, mass, sins of (editorial).....	445
Serum for group "A" hemolytic streptococci, concentration of grouping...	641
Service, naval, aphorisms on peptic ulcer seen in.....	207
Services program, health, in Trust Territory of Pacific Islands.....	925
" <i>Shigella flexneri</i> III" following an epidemic; prolonged laboratory observa- tions on clinical cases and carriers of.....	405
Shipyard, naval, mass photofluorography in.....	809
Simple dislocation of talus without fracture; report of case.....	914
Sins of mass serology (editorial).....	445
Six atypical cases of syphilis.....	547
Skin grafts, pedicle, in repair of surface defects of lower extremities, use of..	373
Smear technique; detection of cancer cells.....	843
"Solace," United States Hospital Ship, wartime log of, from June 1943; part I.....	577
"Solace," United States Hospital Ship, wartime log of, from June 1943; part II.....	750
Sore throats aboard U. S. S. "Oregon City," outbreak of scarlet fever and..	643
Special merit, articles of, published in U. S. Naval Medical Bulletin during 1947 (editorial).....	96
Specific therapy in osteomyelitis.....	175
Spleen, rupture of, in infectious mononucleosis; report of case.....	460
Splenic neutropenia, primary, with concomitant lymph node changes.....	729
Spontaneous chylous ascites; report of case.....	794
Spread of influenza A and other acute respiratory diseases in United States Naval training center.....	478
Station, naval, dispensary.....	76
Streptococci, hemolytic, concentration of grouping serum for group "A"...	641
Streptothricosis; report of case with recovery.....	399
Studies, filariasis, in American Samoa.....	327
Studies, tracer, general principles and purposes of.....	649
Study, all-island tuberculin-patch test, tuberculosis program on Guam including.....	700

	Page
Study of effect of breathing oxygen or normal air after exposure to atmosphere having high concentration of carbon dioxide.....	234
Study of 200 violators of general court-martial probation.....	81
Study, radiographic, of fractures of carpal navicular bone.....	66
Submarine food problems in World War II, analysis of.....	683
Substitutes, blood, in treatment of burns, fluids and (editorial).....	99
Sulfadiazine anuria; its relief by bilateral renal decapsulation and nephrostomy.....	448
Suppurative infection, acute appendicitis developing during penicillin therapy for; report of case.....	879
Surface defects of lower extremities, use of pedicle skin grafts in repair of..	373
Surface defects of lower extremity, plastic repair of.....	823
Surgery, orthopedic, importance of leprosy in.....	656
Surgery, plastic, repair of acquired forehead defects by tantalum cranioplasty and; report of two cases.....	773
Surgical removal of odontoma and impacted anterior teeth; report of case..	116
Surveys, medical, for pulmonary tuberculosis.....	632
Suture material, reactions to (editorial).....	771
Syndrome, Reiter's, discussion of, report of case.....	503
Syndrome, Waterhouse-Friderichsen's (epidemic cerebrospinal meningitis); report of two successfully treated cases and one fatal case.....	907
Syphilis, acute appendicitis during penicillin therapy for; report of case..	881
Syphilis, six atypical cases of.....	547
Talus, simple dislocation of, without fracture, report of case.....	914
Tantalum cranioplasty and plastic surgery; repair of acquired forehead defects by; report of two cases.....	773
Technique for alveolectomy.....	847
Technique, rapid, for diagnosis of scabies.....	566
Technique, smear; detection of cancer cells.....	843
Teeth, impacted anterior, surgical removal of odontoma and; report of case.....	116
Teeth, infected pulpless, root canal fillings in; preliminary report.....	868
Ten greatest advances in medicine (editorial).....	769
Termination, fatal, acute disseminated lupus erythematosus with.....	286
Testis, benign tumors of; report of case.....	893
Therapy of rheumatic fever, observations of efficacy of Benadryl in.....	380
Therapy of throat infections with bismuth vs. penicillin (WARNING concerning use, p. 414).....	61
Therapy, penicillin, for suppurative infection, acute appendicitis developing during; report of case.....	879
Therapy, penicillin, for syphilis, acute appendicitis during; report of case..	881
Therapy, pneumoperitoneum; discussion of pulmonary tuberculosis treated with phrenic crush and; report of two cases.....	454
Therapy, specific, in osteomyelitis.....	175
Thoracis, acute empyema, nonoperative treatment of, with penicillin; discussion of its limitations and subsequent surgical management of its failures.....	513
Throat infections, therapy of, with bismuth vs. penicillin (WARNING concerning use, p. 414).....	61
Tissue, placental, of sensitized women, production of anti-Rh sera from..	370
Total cystectomy with bilateral ureterisigmoidostomy for carcinoma of bladder.....	601

	Page
Toxicity of local anesthetics.....	871
Tracer studies, general principles and purposes of.....	649
Tract, visual, case of migraine with lesion localized in.....	290
Traumatic rupture of mesentery of Meckel's diverticulum; report of case..	467
Treatment, modern, of progressive deafness.....	1
Treatment, nonoperative, of acute empyema thoracis with penicillin; discussion of its limitations and subsequent surgical management of its failures.....	513
Treatment of acute sacrococcygeal cyst teratoma.....	250
Treatment of burns, fluids and blood substitutes in (editorial).....	99
Treatment of chancroidal ulcers, efficacy of penicillin iontophoresis in treatment of; ion transfer of penicillin.....	40
Treatment of combat fatigue, use of plasma in.....	226
Treatment of, conservative, placenta previa (editorial).....	267
Treatment of fractures of edentulous mandibles; a review.....	415
Treatment of frostbite (editorial).....	99
Treatment of herpes zoster with cowpox vaccine; herpes zoster following exposure to varicella.....	742
Treatment of leprosy, new paths in (editorial).....	595
Treatment of paraplegics, advances in (editorial).....	95
Treatment of yellow fever (editorial).....	269
Treatment, simple efficient method of; pterygium.....	395
Tropical hygiene and living in tropics, general information regarding.....	258
Tropics, general information regarding tropical hygiene and living in.....	258
Trust Territory of Pacific Islands, health services program in.....	925
Truth about marihuana (editorial).....	596
Tuberculin patch test study, all-island, tuberculosis program on Guam including.....	700
Tuberculosis program on Guam including all-island tuberculin patch test study.....	700
Tuberculosis, pulmonary; experiences in naval hospital.....	921
Tuberculosis, pulmonary, medical surveys for.....	632
Tuberculosis, pulmonary; review of sixty-six cases with anatomical find- ings.....	132
Tuberculosis, pulmonary, treated with phrenic crush and pneumoperi- toneum therapy; report of two cases, discussion of.....	454
Tularemia; report of case.....	102
Tumor, glomus, with report of case.....	901
Tumor, metastatic, in heart; report of case.....	275
Tumors, benign, of testis; report of case.....	893
Two methods for application of DDT in field.....	797
Typhus vaccine injection, fatal anaphylaxis following.....	303
Ulcers, chancroidal, efficacy of penicillin iontophoresis in treatment of; ion transfer of penicillin.....	40
Ulcer, peptic, seen in naval service, aphorisms on.....	207
Ulcer, perforating peptic, rapid healing of, following vagotomy; report of case.....	792
Unit, air-borne photofluorographic.....	496
United States Naval Hospital Ship "Solace" from June 1943, wartime log of; part I.....	577
United States Naval Hospital Ship "Solace" from June 1943, wartime log of; part II.....	750

	Page
United States naval hospital, use of curare in anesthesia in.....	668
University of Pennsylvania, Dental School, modification of oral photographic apparatus originally constructed by.....	312
Ureterosigmoidostomy, bilateral, for carcinoma of bladder, total cystectomy with.....	601
Use of curare in anesthesia in United States naval hospital.....	668
Use of hyaluronidase.....	865
Use of pedicle skin grafts in repair of surface defects of lower extremities.....	373
Use of penicillin in dental infections.....	120
Use of plasma in treatment of combat fatigue.....	226
U. S. S. "Benevolence," anesthesia activities aboard.....	190
 Vaccine, antirabies, encephalitis due to; report of case.....	 620
Vaccine, cowpox, treatment of herpes zoster with; herpes zoster following exposure to varicella.....	742
Vaccine injection, typhus, fatal anaphylaxis following.....	303
Vagotomy, rapid healing of perforating peptic ulcer following; report of case.....	792
Vapor hazard, potential mercury, in Gyro laboratory.....	139
Varicella, herpes zoster following exposure to; treatment of herpes zoster with cowpox vaccine.....	742
Venereal disease among naval prisoners.....	722
Venereal disease control by punishment.....	919
Violators of general court martial probation, study of 200.....	81
Visual tract, case of migraine with lesion localized in.....	290
 Waterhouse-Friderichsen's syndrome (epidemic cerebrospinal meningitis); report of two successfully treated cases and one fatal case.....	 907
Wartime log of United States Naval Hospital Ship "Solace" from June 1943; part I.....	577
Wartime log of United States Naval Hospital Ship "Solace" from June 1943; part II.....	750
Water, salt and fresh, drowning in (editorial).....	595
Wellcome prize in 1947 (editorial).....	269
What makes a disease important? (editorial).....	770
Where is the appendix? (editorial).....	266
Women, sensitized, production of anti-Rh sera from placental tissue of.....	370
World War II, medical history of Navy (editorial).....	268
 Yellow fever, treatment of (editorial).....	 269

INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 48

INDEX TO AUTHORS

	Page		Page
Abrams, Robert C.....	306	Delaney, Adrian J.....	1, 503
Adams, Jesse F.....	250	Dierkhising, O. C.....	478
Anderson, Robert K.....	778	Downs, Ralph A. Jr.....	901
Aston, Melville J.....	809	Drake, Eugene H.....	577, 750
Ayres, William W.....	941	Duff, Ivan F.....	683
Babione, Robert W.....	342, 919	Duffner, Gerald J.....	234
Bachman, Kenneth P.....	854	Elburn, Maynard K.....	120
Barker, Vincent L.....	298	Engelfried, John J.....	370
Barksdale, Edwin E.....	883	Enyart, John L.....	66
Barnes, La Verne A.....	405	Faucett, Ralph E.....	865
Bell, Landes H.....	914	Fischbach, William M.....	69
Bell, Luther G.....	729	Fleck, Robert L.....	729
Berkley, William L.....	290	Floyd, Thomas M.....	240
Boyden, Robert C.....	912	Foley, George E.....	386
Braun, Winston.....	275	Fowler, John A.....	448
Britten, Sidney A.....	132, 632	Fox, Joseph Robert.....	118
Brown, Harry J.....	66	Freedman, Lawrence Z.....	722
Brown, Robert B.....	7, 107, 513	Frost Dwight, M.....	883
Bullwinkel, Henry G.....	395, 610	Fuller, Roger.....	818
Byron, Ralph L., Jr.....	93	Gaenslen, Frederick G.....	306
Caes, Henry J.....	298	Gemmill, Chalmers L.....	649
Callahan, John J.....	229	Gerber, Marvin L.....	881
Calvy, George L.....	616	Giannini, John T.....	773
Carpenter, Cedric C.....	566	Gilliam, Robert D.....	290
Carson, Leon D.....	76	Godfrey, Ellwood W.....	7
Chipman, Irvin Lewis, Jr.....	253	Golden, Howard.....	22
Clare, Frank B.....	778	Graham, Sam D.....	838
Clark, David G.....	190	Gray, J. A. C.....	921
Cohn, Theodore.....	510	Greaves, Frederick C.....	925
Connelly, Joseph R.....	180	Griffin, James F.....	797
Cooper, Henry R.....	102	Gunther, Lewis.....	207
Crowe, Walter W.....	278	Harrison, Russell R.....	405
Cureton, Murphy K.....	353	Haynes, Lewis L.....	794
Davis, Harwell G., Jr.....	613	Hays, Thomas G.....	7
Deas, Thomas C.....	112	Hayter, Robert.....	234

	Page		Page
Heisser, Carl J.....	632	Olenick, Everett J.....	538
Henderson, Arvin T.....	865	Otness, H. Robert.....	81
Henry, Frederick R.....	370	Pedroso, Odair Pacheco.....	437
Hering, Eugene R.....	797	Pereyra, Armand J.....	40
Hicks, Samuel P.....	460	Philbrook, Frank R.....	405
Hoen, Thomas I.....	778	Prince, James T.....	641
Hoffmann, George Towle.....	275	Reitz, Harvey E.....	198
Horton, Samuel H., Jr.....	742	Reitzel, Elbert C.....	555
Huebsch, Raymond F.....	116	Requarth, William.....	373
Huie, Robert E., Jr.....	897	Research Unit No. 4, United States Naval Medical.....	380
Humphrey, James C.....	613	Reynolds, Charles W.....	668
Hungate, Carroll P.....	437	Rosati, Guido J.....	139
Jackson, Frank A.....	139	Schafer, Walter L.....	399
Jacobziner, Harold.....	700	Schlack, Carl A.....	312
Jarrett, Elma T.....	478	Schuster, Boris.....	61
Jeffers, Clark P.....	139	Shilling, Charles W.....	683
Jessner, Max.....	434	Shipley, Norman B.....	868
Johnson, Ferrell H.....	792	Siegler, Alvin M.....	620
Johnson, Spencer.....	893	Silliphant, William M.....	569
Johnston, William C. B.....	81	Smith, Bruce H., Jr.....	787
Kearney, Edward A.....	792	Smith, James T.....	180
Kettering, Harry A.....	912	Smith, Philip N.....	510
Kingston, James R.....	478	Solomon, Philip.....	226
Kloos, Edward.....	773	Sprague, Howard B.....	577, 750
Knox, George W.....	555	Storey, Clifford F.....	448, 601
Knudtson, Kenneth P.....	843	Strange, William W.....	577, 750
Krueger, Albert P.....	510	Straughan, Joseph M.....	180
Kullman, Harold J. F.....	22	Sulzberger, Marion B.....	434
Lewis, Gwilym B.....	161	Swanson, Clifford A.....	1, 503
Liedman, Sidney C.....	415	Talley, A. T., Jr.....	601
Loeser, William D.....	809	Taylor, Ralph W.....	116
Loré, John M.....	490	Trunnell, Jack B.....	66
Lowe, Edward S.....	52, 467	Tuchewicz, Henry.....	818
Magiera, Stephen L.....	463	Tyson, Ralph R.....	643
Marsh, William C.....	391, 831	Ulen, Francis G.....	528
Martin, Frederick J.....	818	United States Naval Medical Re- search Unit No. 4.....	380
McCann, William J., Jr.....	405	Wagner, Alfred T.....	879
McCoy, James J., Jr.....	272	Walker, Russell H.....	303
McGinty, Arthur P.....	577, 750	Wallace, Stanley L.....	865
McGuire, Charles D.....	510	Walters, John D.....	871
Metcalf, John W.....	175, 656	Ware, Robert L.....	153
Meyer, Frederick W., Jr.....	907	Weaver, Edgar N.....	773
Miller, Vernon L.....	555	Weisser, John R.....	879
Morrell, James F.....	547	Wells, James L.....	887
Morton, Paul H.....	112	Wells, W. H.....	478
Mount, Robert A.....	240	Wickstrom, Otto W.....	823
Moxon, Robert K.....	286, 513	Wigand, Frederick T.....	847
Murray, William D.....	327	Wiggins, Howell E.....	161
Myers, W. P. Laird.....	887	Williamson, Richard.....	818
New, William N.....	391, 831	Zarriello, Jerry J.....	454
Newman, William A.....	698		
Nolan, James J.....	883		

INDEX TO MARCH-APRIL 1948 SUPPLEMENT TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 48

INDEX TO SUBJECTS

	Page
Abundance, isotope, preparation of gas samples for mass spectrometric analysis of	82
Administration of isotopes to animals and man, dosage levels in	161
American Chemical Society, 112th meeting, program of	vii
Analysis, mass spectrometric, of isotope abundance, preparation of gas samples for	82
Animals and man, dosage levels in administration of isotopes to	161
Application of radioisotopes to problems of naval medicine	17
Aspects, medical, of atomic disaster plan	185
Atomic disaster plan, medical aspects of	185
Basic ideas in theory of radioactivity and detection of radiation, synopsis of	94
Biochemical problem, illustration of power of isotopes in	176
Chemical methods of isotope separation	205
Criteria of purity, detection of intermediates	115
Cyclotron and other methods, production of radioactive isotopes by	52
Detection of intermediates, criteria of purity	115
Detection of radiation, synopsis of basic ideas in theory of radioactivity and	94
Determination of hard radiation, including preparation of samples	100
Determination of soft radiation, including preparation of samples	104
Diffusion, thermal, and other physical methods of isotope separation	28
Disaster plan, atomic, medical aspects of	185
Dosage levels in administration of isotopes to animals and man	161
Equipment, laboratory handling of radioactive material; protection of personnel and	164
Fundamentals of isotope separation	6
Gas samples for mass spectrometric analysis of isotope abundance, preparation of	82
Handling, laboratory, of radioactive material; protection of personnel and equipment	164
Hard radiation, determination of, including preparation of samples	100
Hazards presented by radioactive materials and how to cope with them	142

	Page
Ideas, basic, in theory of radioactivity and detection of radiation, synopsis of	94
Illustration of power of isotopes in biochemical problem	176
Intermediates, detection of, criteria of purity	115
Introductory remarks	1
Introduction to radioisotopes number of U. S. Naval Medical Bulletin	v
Isotope abundance, preparation of gas samples for mass spectrometric analysis of	82
Isotopes, administration of, to animals and man, dosage levels in	161
Isotopes in biochemical problem, illustration of power of	176
Isotopes, radioactive, pile production of	42
Isotopes, radioactive, production of, by cyclotron and other methods	52
Isotope-ratio measurements, new mass spectrometer for	60
Isotope separation, chemical methods of	205
Isotope separation, fundamentals of	6
Isotope separation, thermal diffusion and other physical methods of	28
Laboratory handling of radioactive material; protection of personnel and equipment	164
Levels, dosage, in administration of isotopes to animals and man	161
Man, dosage levels in administration of isotopes to animals and	161
Mass spectrometer, new, for isotope-ratio measurements	60
Mass spectrometric analysis of isotope abundance, preparation of gas samples for	82
Material, radioactive, laboratory handling of; protection of personnel and equipment	164
Materials, radioactive, hazards presented by, and how to cope with them	142
Measurements, isotope-ratio, new mass spectrometer for	60
Medical aspects of atomic disaster plan	185
Medicine, naval, application of radioisotopes to problems of	17
Methods, chemical, of isotope separation	205
Methods, other physical, of isotope separation; thermal diffusion and	28
Methods, other, production of radioactive isotopes by cyclotron and	52
New mass spectrometer for isotope-ratio measurements	60
Naval medicine, application of radioisotopes to problems of	17
Personnel and equipment, protection of; laboratory handling of radioactive material	164
Physical methods, other, of isotope separation; thermal diffusion and	28
Pile production of radioactive isotopes	42
Plan, atomic disaster, medical aspects of	185
Power of isotopes in biochemical problem, illustration of	176
Preparation of gas samples for mass spectrometric analysis of isotope abundance	82
Preparation of samples, determination of hard radiation, including	100
Preparation of samples, determination of soft radiation, including	104
Problem, biochemical, illustration of power of isotopes in	176
Problems of naval medicine, application of radioisotopes to	17
Production of radioactive isotopes by cyclotron and other methods	52
Production, pile, of radioactive isotopes	42

	Page
Program of American Chemical Society, 112th meeting.....	vii
Protection of personnel and equipment; laboratory handling of radioactive material.....	164
Purity, criteria of, detection of intermediates.....	115
 Radiation, detection of, synopsis of basic ideas in theory of radioactivity and.....	 94
Radiation, hard, determination of, including preparation of samples.....	100
Radiation, soft, determination of, including preparation of samples.....	104
Radioactivity and detection of radiation, synopsis of basic ideas in theory of.....	94
Radioactive isotopes, pile production of.....	42
Radioactive isotopes, production of, by cyclotron and other methods.....	52
Radioactive material, laboratory handling of; protection of personnel and equipment.....	164
Radioactive materials, hazards presented by, and how to cope with them.....	142
Radioautographic technique.....	122
Radioisotopes, application of, to problems of naval medicine.....	17
Ratio measurements, isotope-, new mass spectrometer for.....	60
 Samples, determination of hard radiation, including preparation of.....	 100
Samples, determination of soft radiation, including preparation of.....	104
Samples, gas, for mass spectrometric analysis of isotope abundance, preparation of.....	82
Separation, isotope, chemical methods of.....	205
Separation, isotope, fundamentals of.....	6
Separation, isotope, thermal diffusion and other physical methods of.....	28
Soft radiation, determination of, including preparation of samples.....	104
Spectrometer, new mass, for isotope-ratio measurements.....	60
Spectrometric, mass, analysis of isotope abundance, preparation of gas samples for.....	82
Synopsis of basic ideas in theory of radioactivity and detection of radiation.....	94
 Technique, radioautographic.....	 122
Theory of radioactivity and detection of radiation, synopsis of basic ideas in.....	94
Thermal diffusion and other physical methods of isotope separation.....	28

INDEX TO MARCH-APRIL 1948 SUPPLEMENT TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 48

INDEX TO AUTHORS

	Page		Page
Axelrod, Dorothy J.....	122	Reid, Allen F.....	205
Bale, William F.....	100	Rittenberg, David.....	82
Cohen, Karl.....	6	Smith, Robert Emrie.....	17
Cohn, Waldo E.....	42	Solomon, Arthur K.....	104
Hamilton, Joseph G.....	122	Sprinson, David B.....	82
Irvine, John W., Jr.....	52	Swanson, Clifford A.....	v
Kamen, Martin D.....	115	Tompkins, Paul C.....	164
King, E. Richard.....	185	Urey, Harold C.....	1
Lisco, Hermann.....	161	du Vigneaud, Vincent.....	176
Morgan, Karl Z.....	142	Washburn, Harold W.....	60
Present, Richard D.....	94	Watson, William W.....	28

981





BR

188

UNIVERSITY OF CALIFORNIA LIBRARY
BERKELEY

Return to desk from which borrowed.

This book is DUE on the last date stamped below.

Biology Library

JUL 11 1950

~~MEB~~ 637253-a

JUN 11 1952

MAY 29 1952

MAY 28 1964

MY25'64BB

LD 21-100m-11,'49(B7146s16)476



